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PRESIDENT'S ADDRESS

RECENT IMPORTANT ADVANCES IN OBSTETRICS AND GYNECOLOGY

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MY FIRST and most pleasing duty is to thank you all for having elected me President of this organization, thus giving me the great honor I hold today.

Before proceeding with the subject in hand, permit me also to express the hesitation I feel in attempting to review the progress made in obstetrics and gynecology during the last few years. It is a task far beyond the scope of one paper. At best, I can only hope to indicate briefly a few of the most important advances which, in addition to their practical value, offer most promise in new fields of investigation for the future. The victories gained, the magnificent results secured become so increasingly marvelous with each passing year that they arouse astonishment, admiration and enthusiasm.

Composed as this association is of distinguished obstetricians and gynecologists, it is obvious that this task is fully as difficult as it is fascinating; and it is undertaken with an earnest appreciation of per-

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sonal limitations in ability to narrate in a fitting way the recent triumphs of our great profession in these two specialties.

I want to call your attention first to the concept of woman as a psychophysical organism in a social and biologic environment, rather than as a member of the female sex of indifferent background with a few pathologic foci of interest for the medical practitioner.

Progress in the field of gynecology is being stimulated by a growing appreciation of the importance of the rôles played by psychologic and sociologic considerations, for who can consider the sexual life of a woman apart from the distortions and modifications to which it is subjected by economic and moral demands of social life? The significance of tracing the functional origin of many gynecologic diseases, always stressing the importance of treating the woman and not the womb, is a new viewpoint that should be stressed today by all teachers and practitioners of obstetrics and gynecology. The problem is often concerned, not with the treatment of symptoms, but with the readjustment of the maladapted organism to its environment.

In this rather cursory examination of some of the recent findings, it will be necessary to consider more isolated problems in what may be called "note fashion." Some of these notes will pertain to practical discoveries, others to more theoretical investigations.

Abnormality of Germ Cells.—With a progressively falling birth rate and the evident desire of many individuals to shirk the responsibilities of parenthood, the question of sterility is today of considerable importance. Sterility is a fairly common condition, and it is possible that deliberate anticonceptional measures, if practiced for any length of time, directly or indirectly, tend to produce a permanent afertile state.

Important work has been done in the gynecologic problem of sterility, work which has opened entirely new fields of research. This development has advanced in the last few years, and holds much promise for all who are interested.

Moench, Mason and Friedlaender have been very active in this line of research work. Friedlaender (Detroit) has demonstrated that the 17 per cent of sterility cases which were classified by him in 1922, as "causes not determined," were all due to abnormalites of the male germ cells. The condition is usually explained by pathologic processes existing in the testicle, but the vitality of the spermatozoa is probably also readily influenced by the character of the secretion of the accessory glands, or constitutional anomalies of the male or both. Even in the apparent absence of orchitis, disturbances of the testicular germinal epithelium and of the spermatozoa can be shown to occur with great frequency in this 17 per cent of cases. All parts of the germ cell are fully developed, but the nucleus is atrophic. This lessening in size of the nuclear elements of the sperm results in a great variety of differently shaped heads. In some, the nucleus is repre-

sented by a bar not much greater in diameter than the connecting piece; in others, there is a gradual tapering off to a point; in still others, cells may be seen in which the tapering, beginning at the nuclear membrane, is abrupt. In the latter the longitudinal measurement of the cell is much lessened, resulting in an almost hemispherical mass. Few abnormal cells are motile and a large number are ejaculated minus their tails. The occurrence of tailless spermatozoa is quite common in the 17 per cent sterility cases and is usually accompanied by further morphologic changes in the nuclear portion of the head.

The findings so far have thus clearly demonstrated that the cause of sterility in the male, leaving aside the physical and psychic elements, is pathologic change occurring in the essential genital organs, which are evidenced clinically only by an alteration in the character of the seminal fluid and the spermatozoa contained therein.

Chemical Reaction Endocervium.—It is generally believed that the cervical secretion may be acid in some cases and excessively alkaline in others, but the cervical reaction is almost constantly and definitely alkaline, as is shown by the splendid studies of Meaker and Glaser. The hydrogen-ion concentration of the endocervical secretions is quite constant. In 100 patients studied, regardless of age, parity, hypoplasia, day of menstrual cycle, endocervicitis and viscosity, following a most painstaking technic for ascertaining the hydrogen-ion concentration, the following observations were made: (1) The cervical reaction was found constantly and definitely alkaline, ranging from P_H 8.0 to P_H 9.0 and being above P_H 8.5 in about 80 per cent of cases. (2) The cervical reaction was not notably influenced by age, parity, the menstrual cycle, endocervicitis, or viscosity of the endocervical mucus. (3) That the vaginal reaction was ordinarily unimportant in relation to fertility or sterility.

The direct spermatocidal effect of a diseased cervical mucosa is however vividly depicted by Reynolds, who, utilizing Hühner's postcoital method for the observation of spermatozoa aspirated from the cervical cavity, states, "It is extremely interesting to see how actively motile spermatozoa progress across the field of the microscope in a cervical secretion of grossly normal appearance, until they come in contact with small clumps of pus-cells, with which the tail of the spermatozoon becomes entangled. The result then is, that it indulges in futile struggles to escape, by the violence of which it becomes exhausted, and in a few minutes gives up the struggle and lies still."

The sterility of women with conical cervix, cervical flexion, or pinhole os, is never due to the cervical malformation per se, but to a coexisting endocervicitis. An os that offers sufficient egress for millions of blood cells during every menstruation, will readily afford ingress to a spermatozoon whose diameter measures less than that of a

single corpuscle. We constantly encounter fecundity in cases of uninfected pin-hole os, and sterility in widely gaping lacerated infected cervices.

The normal cervical lining is not essential to conception or gestation, but a diseased lining is inimical to both, and should be treated by surgical procedure. Removal of a cone by the method of Arnold Sturmdorf should be the procedure of choice. Sturmdorf says, "I would not dogmatically attribute the cure of sterility to this operation any more than to other procedures, for there is too much that is unknown and unknowable involved in the problem; but I may assert, after a very extensive and critical trial, that the method as outlined radically eliminates chronic endocervicitis—the one established causative factor in the sterility of cervical origin."

Relationship Between the Endocrine Glands and Genital Organs.—At this point, we wish to mention the research work of Zondek and Aschheim who have apparently solved a most important problem on the interrelation between the endocrine glands and the genital organs. Their work has shown that the doctrine of "priority of the ovum" as was taught by many investigators was not convincing. They have proved that in animals after the radiation of the ovaries with large doses of x-rays, the estrus continues, although not one living ovum can be seen histologically. From this they have concluded that the ovum could not be superior to the ovarian hormone; on the other hand they have shown that the ovarian hormone could not influence the ripening of the ovum or follicle. They have further shown in a positive manner that the hormone of the anterior pituitary gland can hasten and produce ovarian function; that is the formation of follicles, production of hormones, and ripening of the ovum. They have succeeded in establishing the evidence of the endocrine relation between the anterior pituitary gland and the genital organs. This was known to a certain extent for a long time in the syndrome of dystrophia adiposo-genitalis and other anomalies.

Relation of Menstrual Cycle to Pregnancy.—In spite of the interesting findings of Zondek, we are still in the dark concerning some questions. Why is it that a regular menstrual cycle occurs if no pregnancy takes place? We probably can explain this by a central regulating system, the character of which is still unknown. Must we allot a greater significance to the living, nonpregnant ovum than we have been accustomed to do? In this respect the work of Allen, Doisy, Papanicolaou, and others is very interesting. They have shown that in spayed mice, the cornified epithelium of the vagina which is a sign of estrus can be produced over a long period by the injection of ovarian hormones. This cannot be done in sexually mature mice where, despite the large doses of hormone, the normal periodic cycle results and predominates. Gravid animals do not react at all to these

hormones. The mice can only be brought to a continued estrus if impregnated, or when impregnable ova are not present. The periodically appearing impregnable ova regularly disturb the estrus. In a normal estrus, the hormone of the anterior pituitary body, which Zondek designates "prolan," also has no effect on the cycle. During pregnancy, an increased amount of anterior pituitary hormone has no power to produce the ripening of new ova. We may then conclude that the ovum has an influence, superior even to that of the anterior pituitary body in the sexually mature organism. The essential factor then is the ovum only. It determines the rhythm and the periodicity of the cycle.

Relation of Anterior Pituitary Body to Pregnancy.—In further comprehensive studies, Zondek and Aschheim have investigated the relation of the anterior pituitary body to the organism of the pregnant woman. They have found the ovarian hormone in the gravid corpus luteum up to the fourth month; in the cortex of the ovary where it is combined with the theca cells of the atretic follicles; and in the mother's blood from the fourth month of pregnancy until the first few days of the puerperium; in the milk during the first few days after delivery, in the cord blood and, principally, in the urine of the mother from the fourth month of pregnancy until the puerperium in increasing quantities up to 1000 mouse units per 1000 c.c. of urine. As the ovary produces relatively small quantities of hormones, we must conclude that the placenta, which is found to harbor large quantities of hormone, must be its most prolific source.

Besides the ovarian hormone, Zondek and Aschheim were able to demonstrate the hormone of the anterior pituitary body in different tissues of the pregnant woman, as well as in the blood and urine. On the basis of the fact that the hormones appear in the urine of the pregnant woman a few days after the impregnation of the ovum, Zondek and Aschheim have developed a method of early diagnosis of pregnancy by injecting a small quantity of the woman's urine into an infantile mouse thereby producing ripening of the follicle, corpus luteum formation and signs of estrus as shown by cornified epithelium in the vaginal smears. The experimental evidence presented serves as the basis for a valuable diagnostic method in early pregnancy thus making available for clinical application these purely scientific investigations.

An attempt to extend this work to human beings is now being made and considerable progress has been attained. Dr. Papanicolaou finds that the various stages of the ovarian cycle in the human being may be detected with considerable accuracy by examination of vaginal smears. The human smear is somewhat more difficult to analyze than that of the lower animals, but with experience it seems perfectly practical to use it as a general indicator. In working with human beings

it has also been found that early stages of pregnancy as well as other abnormal conditions of the ovary and uterus may possibly be detected by characteristic changes in the nature of the vaginal smear as modified by pregnancy and his study is being actively continued at the present time. However much more clinical investigation is necessary in order to understand thoroughly the changes in the pregnant uterus which may modify the nature of the vaginal secretion.

Finally, in the light of the recent advances which have been made by the use of the vaginal smear method we are encouraged to hope that much accurate quantitative knowledge may soon be obtained regarding the functions of the various ovarian secretions. This method of study also furnishes a clear-cut means of detecting the influence of the secretions from other endocrine glands on the ovarian reaction. The relationship between the thyroid and pituitary and the ovary may be further elucidated by the present methods of study.

It is a remarkable fact that the vaginal smear is a histologic indicator as accurate and clean cut in its response to chemical changes in the body as is any other type of diagnostic reaction and as such may aid in facilitating the more accurate chemical isolation of gonadal hormones.

In discussing the physiologic principles of the Zondek-Aschheim reaction of pregnancy, Brühl reports the results of the test in 192 cases. On the basis of his observations he concludes that the test gives correct positive or negative results in nearly all cases.

We must sound a word of warning here. We must not judge the complex synthesis and analysis in the woman's endocrine laboratory in a one-sided manner. We must not forget the regulating influences of the whole endocrine symphony. Mahnert has shown that the stimulating effect of the anterior pituitary hormone on the graafian follicle is regulated during the height of ovarian hormone, while the secretions of the other endocrine glands are not able to perform this regulatory function. Especially interesting are the findings of Baniecki, Berlinger and Adachi, who were able to produce typical pregnancy changes in the anterior pituitary gland by the injection of placental substance. These changes are evidenced by an increase of the chief cells, and a relative decrease of the eosinophiles at the same time. If we consider that, according to Zondek and Aschheim's experiments, we find a large amount of ovarian hormone in the placenta, it is reasonable to believe that the changes found during pregnancy in the pituitary are mostly caused by the ovarian hormone. This was further corroborated by repeated injections of ovarian hormone in male and female animals. Only the female animals showed changes in the pituitary gland. This leads to the conclusion that the ovarian hormone is sex specific. The same changes can be noticed after the injection of urine from pregnant women in which the ovarian hormone

has been demonstrated. From this, we conclude that although the pituitary hormone is of great importance in the woman's sexual life, nevertheless, the ovary predominates over its function and still remains the sovereign over the female sexual life.

Importance of the Uterine Hormones.—In considering all of the internal secretions in relation to the reproductive organs of the woman, investigators have been in the habit of considering the uterus of secondary importance, although Henkel in 1911 showed the existence of a definite relationship between uterus and ovaries. That the ovaries undergo very severe degenerative changes after hysterectomy has been repeatedly demonstrated. This was ascribed to trauma and other causes, no one holding the endocrine disturbance of the uterus responsible for it. Zimmerman, through very interesting experimental work, seems to have settled this question. After extirpation of the uterus he found typical changes in the ovaries. In rabbits he found after two months a breaking down of the ovum in the graafian follicle, and after six months small cystic degeneration of the ovaries. Where uterine tissue was transplanted, the above-mentioned changes did not take place. This is evidence enough to show that the changes in the ovaries are not the result of trauma incident to the hysterectomy, and that the uterus through some hormone of its own is essential for the preservation of a normal ovary. Zimmerman also showed that the uterine hormones are located in the endometrium, for as long as there was any endometrial tissue present in the transplanted uterine tissue there were no destructive changes found in the ovaries of the animal.

Animal experiments seem to prove quite definitely that the ovarian follicular hormone is not the only hormone produced by the ovary. The corpora lutea produce one that amplifies the reaction which has been started by the ovarian follicular hormone. Under the influence of the latter, the mucous membrane lining of the uterus develops to several times the thickness it has when quiescent. At the end of this proliferation phase the ova are released from the ovaries and descend through the tubes into the uterus. The corpora lutea quickly develop in the cavities vacated by the ova, and elaborate a hormone which causes great development of the glands in the uterus.

In this condition, the mucous membrane furnishes a peculiarly suitable place for fertilized ova to attach themselves and receive nourishment and stimulation for their development. This sensitization of the mucous membrane of the uterus, so that the ova will become attached to it, is the most important function of the corpora lutea. In addition, they have an inhibitory action on the follicular part of the ovary, and they delay the production of the ovarian follicular hormone, thus preventing excessive stimulation of the uterus itself, which might interfere with the development of the ova into embryos.

In case the ova have not been fertilized or fail to attach themselves to the uterus, the corpora lutea lose their activity after a few days and the cycle ends in degeneration and casting off of the lining of the uterus. Therefore, by properly combining the use of ovarian follicular hormone with an extract of corpora lutea, which contains lipoids of corpora lutea, the normal series of events in the uterus can be simulated. The proliferative phase can be produced by the ovarian follicular hormone and the secretory, or glandular, phase can be produced by the lipoids of corpora lutea. This use of these two ovarian products is in accord with the ideas of Emil Novak, who has published several articles on the subject. To sum up the clinical uses of these two products it may be said: The specific indications for ovarian follicular hormone are of course menopause, either natural or surgical, sexual frigidity, and the abnormalities of menstruation, such as dysmenorrhea and menorrhagia. Excellent results are obtained by using ovarian follicular hormone during the first half of the month following menstruation and corpora lutea extract during the latter half.

Contractions of Uterus.—Another important investigation has been made by Knaus, who has demonstrated that the isolated uterus contracts in a quicker rhythm than the uterus in situ. This is due to the separation of the inhibitory nerves located in the central nervous system. What seems to be highly interesting is that in the gravid uterus of the rabbit the pregnancy up to the seventeenth day cannot be interrupted, even with large doses of pituitrin. This is shown in the uterus in situ, as well as in the isolated extirpated uterus. From the eighteenth day of the pregnancy the condition of the uterus changes to a great extent. It is possible then to induce an abortion with very small doses of pituitrin. This is of great scientific and clinical importance. It is believed that the change in the contractibility of the uterus is brought about by the endocrine hormones of the genital system which influence the uterine muscle cells in a specific way, and which cannot be removed even by washing of the extirpated organ, so that the uterus keeps the motion impulse which it possessed at the time of extirpation. It has been shown that the uterine contractions differ during the first and second part of a pregnancy and during the puerperium. The inertness of the uterine contractions in the first half of pregnancy is ascribed to the hormonal action of the corpus luteum which neutralizes or paralyzes the hormone of the *posterior pituitary gland.* The piling up and formation of hormones in the placenta cause a steady increase in resistance of the uterus to the action of the hormone of the posterior pituitary until parturition sets in. During the puerperium we have, due to the inactivity of the ovarian function, a state which is allied to senility. With the application of these suggestive investigations to obstetrics, a vista of possibilities is unfolded relative to problems which have so

far remained unsolved. The etiology of missed abortion or missed labor is now brought closer to an intelligent interpretation than ever before. That the uterus does not respond very often to ecbolics in incomplete abortions, the primary insufficiency of labor pains without pathologic overstretching of the uterus by hydramnion or twins, are questions which will probably be solved by the research work of Knaus, and these solutions should lead us to a rational etiology and therapy.

A Specialized Type of Muscle in the Human Pregnant Uterus.—In a recent piece of work by Hofbauer, explanation may be found, at least in part, for the difference in uterine contractions during the first and latter half of pregnancy. Hofbauer calls attention to the development in the outer layer of the pregnant uterus of a specialized structure of muscle tissue with microscopic features in marked contrast to those of the rest of the uterine musculature and closely resembling the *Purkinje system of the heart.*

The study of the histologic structure of the wall of the pregnant uterus shows that beneath the peritoneal covering there is a thin superficial layer of relatively compact longitudinal fibers followed by a thicker layer of circular fibers spread apart by characteristically arranged connective tissue spaces containing many vessels. Internal to this is a layer of muscles interlacing in both directions, and internal to that is the bulk of the uterine muscle, which consists of a dense felt-like mass of fibers extending to the base of the decidua. The development of the longitudinal bundles is most pronounced in the middle third of the anterior wall. In the posterior wall the structure terminates half way between the fundus and the internal os. On the posterior wall of the lower uterine segment there is a superficial band of longitudinally arranged fibers which spreads horizontally toward both sides.

The specialized system in the outer portion of the pregnant uterus is visible to the naked eye as distinct longitudinal bands which are mainly parallel.

In the author's opinion, the system described may be designated as the pacemaker of the parturient uterus.

This peculiar formation may be demonstrated after the fourth week of pregnancy and is well developed by the middle of pregnancy. In the premenstrual period the muscle fibers of the outer layer show a definite swelling of their cytoplasm. The evidence indicated that the muscle structure described develops from the subserous connective tissue.

The Use of Thymophysin.—Thymophysin is a combination of the extract of the hypophysis and the extract of the thymus gland. Temesvary is given all the credit for the experimental work. He was able to show that by its injection into an animal, normal uterine contrac-

tions were rapidly and rhythmically stimulated. Following this work Graff in Vienna and others began to use it in their clinics and were able to show that in the great majority of cases labor could be excited and strengthened, while at the same time its physiologic character was preserved.

L. W. Haynes, who has had the largest experience with the use of thymophysin of anyone in America, in private correspondence states: "We started our work with this preparation in the fall of 1926 and have recently completed an analysis of the records of our first five hundred cases. Our indications for the use of thymophysin are primary and secondary inertia, and as an aid in the induction of labor. A summary of our results is as follows: Out of 424 cases of inertia, 280 gave satisfactory results for rapid delivery; 110 resulted in rapid, complete dilatation where surgical intervention was possible at a much earlier time. There were 34 failures in the inertia classification. In 74 cases we used it as an aid in the induction of labor. When used with other ecbolics which are in general use, a rapid labor resulted in 49 cases. There were 27 failures in this group. No ill effects have been noted on either mother or baby."

Thyroid Dysfunction and Reproduction.—In these investigations of the action of the endocrines, we must, as has been previously emphasized, be extremely cautious not to consider the biologic facts in a one-sided manner. Doederlein, Junior, has called our attention recently to the relation of hyperthyroidism to reproduction of progeny. He has found that disturbances of the normal thyroid function diminish the chances of fertility; that this is true of hyperfunction as well as hypofunction. He has also shown that the consequences of hyperfunction of the thyroid differ with the sex. In the female, slight and medium hyperthyroidism interferes neither with the fertility nor the pregnancy, while the male fertility is reduced and the progeny is of inferior type. Severe forms of hyperthyroidism suppress the fertility or result in abortion. It is especially valuable to know that every hyperfunction of the thyroid renders the mother more prone to a stormy puerperium.

Knowing that severe hyperthyroidism is a cause of sterility, Haberland advocated the production of artificial sterilization in women by the administration of thyroid. But the doses required to obtain the desired effect were so large that they became dangerous to the health of the woman.

In our investigations of sterility we must therefore include the possibility of hyperthyroidism in one of the partners as a cause. This is especially so in the male, for, as we have mentioned before, slight or medium hyperthyroidism renders the men sterile.

The fetus also is affected by the hormones which circulate in the blood of the mother. These hormones penetrate the placenta and may

bring about a temporary disturbance of the metabolism of the fetus. Soon after birth this condition changes to normal, or nearly so, in healthy individuals. However, if there are signs or symptoms of exophthalmic goiter, or the mother actually has Basedow's disease, then there is always a congenital anomaly.

External Influences on Germ Plasm.—Here, too, there is evidence that even such complex molecular substances as the hormones are able to penetrate the placenta. That various chemical compounds are able to reach the fetus by way of the placenta has been known for a long time. It has also been known that certain microorganisms from the blood of the mother were able to reach the fetus and produce the same disease as the mother possessed. However, it was not known until recently, that even more highly organized microorganisms were able to infect the fetus by way of the placenta. This question was settled by the research work of Ernest Philipp, in Stoeckel's Clinic. His work showed a definite difference in the behavior of the trypanosoma and spirochete. The former cannot pass the placenta, while the latter infect the fetus diaplacentally. Their morphologic structure may be the cause of the behavior of these microorganisms. No structural changes can be found in the villi of the placenta which might have been caused by the peregrination of the spirochete. This conclusive evidence changes the view of the nature of infection of the fetus with syphilis from a germinative to a diaplacental process.

An interesting phase of the dangers attached to the early months of gestation is the biologic evidence put forward by Arthur Robinson indicating that the cause of some abortions lies in an inherent lack of vitality of the fertilized ovum. The product of conception dies in utero and unless retained as a carneous mole, is expelled as a foreign body. In many cases it is not possible to prevent abortion due to this cause. However, attempts based upon comparative physiology are being made to increase the vitality of the ovum by the addition to the diet during pregnancy of an increased quantity of Vitamin E, the recently discovered reproductive vitamin, the withholding of which from the diet tends to produce death of the fertilized ovum. This vitamin is present in certain foods in considerable quantity, notably in wheat, peas, and lettuce. Generally speaking it is found most abundantly in the lipoid extracts of cereal grains, but is abundant also in various kinds of leafy vegetables.

If as we now believe, a vitamin exists, that determines whether or not a prospective parent shall have any progeny at all, this is certainly an effect on the germ plasm and the principle once having been demonstrated simply needs more knowledge and instrumentalities to carry its application further. Going further than this, recent evidence is available proving the reversibility of sex in higher organisms. Such evidence supports the thesis of external factors being capable

of profoundly influencing the germ plasm. If such influence can affect a factor so important as the sex of an individual, it is a tenable postulate that every hereditary factor is in some degree under possible control or modification by scientific means. Thus according to Fisk, the supposedly inviolate nature of the germ plasm is shown to be a pure myth, a dogma that is finally laid at rest by scientific demonstration. In spite of the amazing and illuminating discoveries already made in cytology there is much territory that has not been touched.

Golgi Apparatus.—Let us consider, as an instance, the strange and bewildering organism, or organization, known as the Golgi apparatus. This apparatus may be either an organization or an organism, heterogenous or homogenous, reflex or vital, no man can yet say. In the restricted and minute portion of each cell, we find a tiny bit of matter in ceaseless fluctuation and, having no better name for it, we call it after its discoverer and there we must, for the present, rest discontent. But while nothing is as yet known about its structure, much has been learned about its conduct. One of these tiny masses is found in each of the myriads of cells that form the complete morphologic structure we name the body. In fact M. Kolliner states that in the investigation of various groups of invertebrates he has come to the conclusion that Golgi's internal apparatus can be recognized in some form in every animal cell. There is a fairly constant form of apparatus in all vertebrates. Within the border of the cytoplasm this speck is in ceaseless and constant fluctuation, and this motion never ceases while life is in the cell. What the purpose of this motion may be, and whether we are here facing the final mystery of the "reason" of biologic vitality, are at present subjects for speculation and research; but the fact that there is fluctuation is established. For much of what is known upon this subject we are indebted to that gifted Japanese scientist Mayagawa.

We are also indebted to C. deFano, who after much experimental work states that in advanced pregnancy the apparatus gains in size, out of proportion to the volume of the cell. After the young are born the apparatus is smaller, apparently due to compression of the secretion in the cytoplasm. During lactation the apparatus is almost identical with that seen at the end of pregnancy. This same author also claims that Golgi's apparatus is a constant feature of the epithelial cells of the mammary gland (mice, rats, cats, rabbits, and guinea pigs). During pregnancy it hypertrophies; and it remains hypertrophic throughout lactation, when it is in part fragmented and shifted and stretched in various directions. It is not a fixed system of intraprotoplasmic canaliculi. During evolution after lactation this apparatus becomes transformed into peculiar shapes deliniated by argentophile material. Most of these cells are eliminated. Some remain as permanent epithelium in which the apparatus is not thrown off with secre-

tory products, but detached cells with their apparatus pass into the glandular lumina, so that in this way the apparatus may take an indirect part in the function of the gland.

The bearing all this has upon our knowledge of obstetrics and gynecology bids fair to be far reaching. Recent observation has shown that when there is a threatened carcinoma, the Golgi apparatus is subject to change in derangement of pattern in that one organ where cancer is forming; so that in a short while a technic of observation may be developed that will warn in time of the approach of this dreaded foe of man. Indeed if the present knowledge of the Golgi apparatus is applied, that warning may even now be observed.

For recent advances in our knowledge concerning this most fascinating subject, particularly during the last four years, we are greatly indebted to DeFano of the Spanish School, and to those especially interested in this line of investigation, I recommend the works of M. Avel on the *Physical Properties of Golgi's Apparatus in Sexual Cells of Gasteropoda*, also that of Z. Grabowska on *Golgi Apparatus in Spermatozoids of Crustaceans*, also *Microscopical Researches on Thyroid Gland of Amphibia with Special Regard to Golgi Apparatus*, by Z. Hirschlerowa.

CONCLUSIONS

From this brief review of recent development in obstetrics and gynecology, it is quite evident that rapid advancement is being made in the more essential biologic problems connected with the normal and abnormal morphology and physiology of the female genitalia.

The magnificence of biologic discovery should command even greater awe than it is accorded. Our present knowledge compared to all that can be known is ludicrously slight. We are intellectual machines geared closely to the past by considerations of conformity, reverence, ease, convenience, safety, and luxury. These factors serve to enslave free speculations and allow but glimpses of the truth. Dazzling discoveries lie outside the narrow mold of conformist thought. Only by wide outlook will they be revealed.

Breadth is required and depth. The broad man who never delves below the surface cannot grasp the significance of complex relationships. The deep theorist of limited information lacks the ability to apply his ideas.

All basic sciences are of vital importance to complete understanding, the basis of effectual progress. They are intimately and fascinatingly related to each other and to the more useful activities of mankind. This should be the basic principle of teaching, rather than dogmatic insistance on this, or that, academic requirement. A steady frictionless flow of discoveries then would result, instead of a retrospective nightmare of a long road of learning traversed in a straitjacket under the goad of humiliation. It would be the beautiful shrine

of inspiration, pleasant to recall and eagerly sought out again and again. The fount of learning would then become the friend and adviser, and corroborator of those who have learned.

Our plea should be for methods of medical education, that are conducive to the correct mental attitude of the future investigator, methods that will stimulate the powers of perception and make every student an interested observer and investigator from the very beginning of his professional career.

The biologic viewpoint, when rightly pursued, will eventually elucidate the many problems with which we have been grappling, and with which we are today so much concerned. Schools should, I believe, aim at encouraging a comprehensive and inclusive outlook, not at destroying originality by overloading the young mind with a multitudinous array of facts. With a carefully studied coordination of biologic fundamentals, the student cannot but be impressed and imbued with the important conception of ultimate values, better fitting him for the investigation not only of the biologic aspects of any problem, but for the study of its purely clinical side as well.

Efforts should be made and methods promulgated by which the well-beaten paths of biologic and clinical studies may be eagerly pursued, as well as those yet uncut through virgin territory.

Only by way of physiologic and biochemical research, and by a comparative study of the simpler structural forms, shall we be able to bring our fascinating art into the realm of scientific perfection.

26 WAVERLY AVENUE.

THE NEW PHYSIOLOGY OF MENSTRUATION AND ITS PRACTICAL IMPLICATIONS IN OBSTETRICS AND GYNECOLOGY

THE JOSEPH PRICE FOUNDATION LECTURE*

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JOSEPH PRICE, in pious honor of whose memory this lecture is offered, lived to see the beginning of the rapid progress in gynecologic pathology which the great increase in gynecologic operating enabled us to make in the early part of this century. That we have not yet been able to equal that progress in the domain of physiology is one of the reproaches of modern gynecology. There are, of course, several good reasons for this, inherent in the nature of the subject. There is the inevitable paucity of physiologic, as compared with pathologic, material provided by our operative procedures; there is the difficulty which a right and proper delicacy adds to the requisite clinical observation of normal function; there is the difficulty of making accurate experimentation on the human subject; there is the difficulty in accurately correlating with human physiology the results of experimental observations carried out in those lower species of animals which most readily lend themselves to such researches. Lastly we have only just succeeded in freeing the subject of menstruation from the trammels of tradition, superstition, and false modesty, which for centuries wrapped it round as with swaddling clothes, and baffled any attempt to investigate its real nature. As a result of all these difficulties, the study of the crucially important function of menstruation has been hindered, and consequently also the proper comprehension of the disorders of this function, which form so large a proportion of the symptoms met with in gynecologic work.

One unfortunate result of our ignorance has been to open up the whole field of menstrual disorders as a happy hunting ground for the empiric endocrine-enthusiast under the not wholly disinterested guidance of the manufacturing chemist. Another has been to expose the sufferers from such disorders to quite unnecessary and unwarranted operations, especially curettage; or to the more incalculable and vastly more irremediable influences of radium and x-rays. That these lines of treatment have probably a great future, when guided by knowledge, is beyond question, but at the outset I would like to sound a note of caution. Every new observation of a really scientific nature regarding the infinite interdependence of the ductless glands only reveals more clearly the

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miraculous complexity of the human organism. One can hardly avoid a shudder when one thinks how often our efforts at treatment must be the merest ignorant and blind tinkering with a mechanism of supreme delicacy; and those of us who would aspire to membership of the angelic band in our profession must see to it that we at any rate tread warily and fearfully, whatever others may do.

These preliminary observations lead me straight to the core of my project, namely, to attempt to summarize lucidly and simply the main results of modern biologic and physiologic researches on the subject of menstruation in so far as I know and understand them, and to present them in a form which we, as working obstetricians and gynecologists, can grasp and handle in our work. The scientific study of menstruation may be taken as starting with Heape's brilliant research in comparative physiology, whereby he worked out an analogy between menstruation in the human female and the preestrum in the lower mammals. It is no part of my purpose to examine in detail the evidence for and against this theory, which has been generally accepted during the last twenty years, and is still championed in the latest edition of Novak's admirable monograph. Rather would I try to put before you the more recent view which seems to me more convincing, and leave it to you to form each his own judgment.

In approaching the subject, the first point which requires to be clearly apprehended is that in all female mammals the generative organs, taken as a whole, have two distinct functions to subserve. One is the sexual or copulative function, whereby the female receives the male gametes into her genital tract; and the other is the reproductive function, which begins with ovulation and includes gestation, parturition, and lactation. We must keep these two functions quite distinct in our minds, for upon that distinction depends our understanding of the problem. In the lower mammals both the sexual and the reproductive functions occur at regularly recurring intervals, so that we have what we may call a sexual cycle and reproductive cycle, each essentially distinct from the other.

The sex cycle of the lower mammals is characterized by the regular recurrence of periods of estrus or sexual desire, and for the performance of the sexual act the genitalia of the female require special preparation. The opening of the vagina becomes enlarged, the vaginal epithelium becomes cornified, the uterus becomes enlarged and congested, and the secretions of the genital tract become increased—all with a view to the reception of the male gametes and to facilitate their swimming up into the oviducts. After the sexual congress, which almost inevitably occurs at this period in animals living in a state of nature, the genitalia begin to regress, and in some species there is actually a sanguineous discharge at this regressive stage, due to the congestion of the whole genital tract. It was the regular recurrence of this discharge,

along with the other phenomena, which has led to its being generally regarded as the analogue of menstruation in the primates and in the human female; and while the analogy is tempting, I believe it to be incorrect.

The second or reproductive function begins with the maturation and dehiscence of the ovum, and in all mammals ovulation is followed by a series of changes in the ovary and the uterus, designed to prepare for the nidation and gestation of the fertilized egg or eggs, changes consisting in the development of the corpus luteum in the ovary and in the vascularization and sensitization of the endometrium of the uterus and its metamorphosis into what we call the decidua. If the fertilized egg is forthcoming, and in the lower animals living in a state of nature it may be assumed that it almost always is, the reproductive cycle continues over the period of gestation and lactation and ends by the return of the ovary and uterus to their "resting" condition, in readiness for a repetition of another reproductive cycle.

If the fertilized egg is not forthcoming, the changes in the ovary and uterus, preparatory to gestation, occur nevertheless and continue up to a point. Very soon, however, the uterus realizes that its preparations are in vain and this condition of partial preparation in the absence of a fertilized ovum, which is known as pseudopregnancy, comes to an end in the return of the organs to the resting condition. The important point is that the reproductive cycle always *begins* in these animals, irrespective of whether an ovum has been fertilized or not; only its duration is determined by the presence or absence of the fertilized ovum. Furthermore, we must remember that, as I have said, in animals living in a state of nature, the frequent correlation in time of estrus (and its inevitable insemination) with the occurrence of ovulation makes for such a high degree of fertility that the condition of pseudopregnancy is rare, as compared with that of true pregnancy. At the same time, the condition of pseudopregnancy is well-known in the bitch and in the rabbit, and can be produced experimentally in other mammals.

Now, when we come to consider the human species and the higher primates, we find conditions changed. The genitalia of the adult human female require no special preparation for the sexual act, and as a result there is no real periodicity nor any restriction in time in the performance of the sexual act. There is no recognizable estrus, no definite, regularly recurring period of sexual desire in the human female. Attempts to establish the contrary have been made, as you are all aware, but in women whose sexual feelings are sufficiently pronounced to admit of such an analysis the results are rather contradictory. In other words, the sexual or estrual cycle has in these species become faint or indecipherable. Nor is it essential to attempt to trace it out, for there is no clear evidence as to the existence of any causal connection between estrus and ovulation. I submit that the two cycles—sexual and repro-

ductive—are originally and essentially separate, and that the synchronism of estrus and ovulation is common in many species merely because it favors a high degree of fertility, and has therefore tended to become perpetuated by the process of natural selection. It is more important for us to concentrate our thoughts on the reproductive cycle, which in the human female, just as in the lower mammals, begins with the maturation of the ovum and its release in the act of ovulation, and continues with certain changes in the ovary and with changes in the uterus which may be summed up in the word "premenstrual," *irrespective whether fertilization occurs or not.* The only difference in that respect is that if fertilization occurs, the cycle revolves through pregnancy to its allotted end. If fertilization does not take place, the cycle continues up to a point and then terminates prematurely. In other words, *in the absence of fertilization, a regularly recurring pseudopregnancy occurs, and its termination is the phenomenon that we call menstruation.*

Menstruation, on this theory therefore, is the end of a pseudopregnancy. It is not analogous to a preestrum and is essentially free from causal connection with any trace of an estrus cycle, which may be thought to be decipherable in human physiology. To my mind this theory is the most convincing that has yet been propounded, and it fits precisely the now established observations regarding the time of ovulation in relation to menstruation.

It may be noted in passing that the failure of a definite estrus to coincide in time with ovulation might be expected to diminish the probable fertility of the human species as compared with the lower mammals, in which such synchronization takes place, and this is undoubtedly true. To some extent it is counterbalanced by the fact that sexual intercourse is not restricted to a few definite periods in the year, and that the opportunities for impregnation are widely scattered. As a matter of fact, the regularly recurrent preparation of the uterus for impregnation, which occurs each month in the healthy adult woman, and which appears to follow each ovulation, provides for a reasonably high degree of fertility in most married women. If it were not so, the modern problem of birth control would not exist.

It is of interest to note also that the stimulus which leads to those changes in the uterus in preparation for pregnancy, which in the absence of fertilization take merely the form of this pseudopregnancy terminating in menstruation, arises in the ovary and not in the ovum. The truth of this is proved by the fact that pseudopregnancy may occur in the entire absence of ovulation or of an ovum, as for example if all the follicles in the ovaries have been destroyed experimentally by x-rays or otherwise. One great object indeed of this regularly recurring preparation for pregnancy on the part of the ovaries and uterus is to relieve the ovum of any responsibility for initiating these preparations.

The ovum is throughout its existence somewhat of a parasite. It receives lodging and board from the body of its mother and it gives nothing in return; and, after its liberation from the follicle, until, if fertilized, it becomes embedded in the decidua, it is in a position of almost complete independence of the mother, and is wholly occupied with the self-importance of its own destiny. Apart, therefore, from the fact that the time interval would be too short for adequate preparations to be made if they were begun only after fertilization had occurred, we cannot imagine the ovum undertaking the function of sending a hormonic message to the uterus to say that it had been fertilized, and would the uterus please prepare a bridal suite for its accommodation. Still less can we expect such a self-sufficient cell to send a message to say that it had been disappointed in its hope of fertilization, and that the uterus might cancel all preparations for its reception. On the contrary, all the evidence shows that it is the ovary which stimulates the uterine changes in the hope that the ovum, which it has just launched upon its career, will be fertilized; and it is the cessation of the ovarian stimulus in the absence of fertilization which leads to the uterine preparations being prematurely undone in the phenomenon of menstruation. May I elaborate this scientifically irreverent description in more correct terms?

The reproductive cycle begins in the ovary just prior to ovulation with the maturation of the follicle, and the formation in the whole ovary, not merely in the follicle nor merely in the ovarian stroma, of an ovarian hormone now usually spoken of as estrin. In this country attention has been focused on this hormone through the work of Allen and Doisy and others, and there is more than a tendency in the literature to refer to it as "the" ovarian hormone, as if it were the one and only such extract. There has been a great deal of work done which threw doubt upon such a conclusion, and the work of Wiesner and Patel,[1] in Edinburgh, and independently that of Corner, in America, have now established that there is at least one other ovarian hormone. Therefore, to this estrin hormone I shall, following Wiesner, apply the noncommittal term of "Alpha." Alpha stimulates estrus in lower mammals and in women produces uterine congestion.

As soon as ovulation has occurred, lutein tissue becomes formed in some quantity; and shortly thereafter a second ovarian hormone, which Wiesner calls "Beta," is elaborated by it. This second hormone, which is formed by the lutein tissue and which Wiesner and Patel claim actually to have isolated, stimulates and governs the preparations in the uterus for the nidation and gestation of the fertilized ovum—causes, in other words, what we know as the premenstrual changes. If fertilization occurs and the little blastocyst embeds itself in the sensitized endometrium, which we now call the decidua, the continued formation of beta by the corpus luteum governs the further develop-

ment of the uterus throughout at least the early months of pregnancy—a point which was first indicated by Fraenkel's great work a quarter of a century ago.

If, on the contrary, fertilization does not occur, the initial supply of the beta hormone formed by the corpus luteum soon becomes exhausted, and the preparatory changes in the uterus due to the action of and followed by beta, and which, as we have already seen, are really of the nature of a pseudopregnancy, come to an end and are broken down in the act of menstruation. Clinically, this is borne out by an observation which I have repeatedly made, and which has been reported by several gynecologists—namely, that if in operating on a woman in the latter half of the menstrual cycle, one removes the maturing corpus luteum, either by removal of the ovary, or by excision or mere expression of the corpus, menstruation infallibly follows within about thirty-six hours, even if it were not due for several days.

A question arises here as to what is the exact link of communication between the embedded ovum and the corpus luteum, which secures the maintenance of that body at full maturity for a considerable number of weeks and thus secures the necessary supply of the beta hormone. I submit that the link must be some hormone formed by the trophoblast of the young ovum, and that this, in all probability, stimulates the corpus luteum not only directly but through the medium of the anterior lobe of the pituitary body.

Now, one of the most interesting features of this recent work is its introduction of the anterior lobe of the pituitary body as an organ of primary importance. The idea of the general dependence of the ovary upon the pituitary body was originally noted by Frölich, and has been elaborated by Evans and Aschheim and other workers both in America and in Europe. It has been proved, for example, that extracts of the anterior lobe stimulate the formation of the corpus luteum and interrupt the periodicity of estrus in the lower mammals. But Crew and Wiesner,[2] in Edinburgh, have carried the investigation further and have demonstrated that the two phases of ovarian activity—what we may call the follicular or estrin or alpha phase, and the corpus luteum or beta phase—are due to the stimulus of two different pituitary hormones, which they have actually isolated from the anterior lobe. These they have designated rho I and rho II respectively. Further, they have produced evidence to prove that rho I induces the production of alpha or estrin in the whole ovary and leads to ovulation and to the formation of lutein tissue, but not to its functioning. Rho II activates the lutein tissue, which was brought into being by the stimulus of rho I, and so stimulates the formation of the beta hormone in the corpus luteum. As might be expected these rho factors can act only through the medium of an ovary. If injected into a castrated animal, they have no effect. On the other hand, the

ovarian hormones do produce changes even in castrated animals; alpha so injected produces estrus in the lower mammals, uterine congestion in woman; beta so injected produces in the uterus the changes of a pseudopregnancy, even in an oophorectomized animal.

Now we pass to what the old preachers would call the application of the doctrine, in other words, to a consideration of the possible implications or applications which the theory just stated may be expected to have upon our practice as obstetricians and gynecologists. Here we enter at once upon a realm in which speculation at present plays a larger rôle than observation; but such speculation is not without its value, provided it is guided by some degree of real knowledge. Speculation, so guided, is surely of the essence of that great process of induction, to which the progress of scientific thought and knowledge owe so much. It is for those of us who are practicing obstetricians and gynecologists to test this theory of the biologists by the assay of clinical observation and, it may be, in the crucible of clinical experimentation: to discard what we may find to be spurious metal, and to mint what we prove to be true into the accepted sterling of observed fact.

Beginning with obstetrics, the first point upon which our theory throws light is the diagnosis of early pregnancy. You will recall that the evidence points to a triangular relationship between the pituitary body, the ovary, and the uterus, particularly the pregnant uterus, containing the trophoblast of the young ovum. It was indicated that probably the trophoblast formed a hormone which stimulated the anterior lobe of the pituitary; that the pituitary in response emitted more of the rho II factor; that this in turn activated the lutein tissue in the corpus luteum of the ovary to the further formation of the beta ovarian hormone; and that this last governed the vascularity, the hypertrophy, and the other changes in the uterus, which are necessary for the safe continuance of pregnancy. Zondek and Aschheim have discovered that in early pregnancy a hormone from the anterior lobe of the pituitary is so freely formed in the mother's system, that it is actually present in the urine in recognizable quantity; and upon the basis of this observation they have elaborated what promises to be a very valuable and practical diagnostic test of the existence of early pregnancy. The test consists in injecting some of the urine into the bodies of young, immature female mice. If the anterior pituitary hormone, or as we may now in the light of Crew and Wiesner's work say, if the rho factors are present in sufficient quantity in the urine, the ovaries of the mice are tremendously stimulated and in the course of three days present clear evidence of precocious and intensive sexual maturity in the shape of great enlargement, follicular maturation, and —what is specific—the presence of hemorrhage in the follicles and of active formation of lutein tissue. This is a positive result, and the

experience of Zondek and Aschheim and of other observers goes to show that a positive result is practically never obtained unless a pregnancy exists in the woman from whom the urine was obtained. The experience of all who have investigated the value of this test goes to show that the margin of error is not more than some 2 per cent. The test, of course, can only be carried out where you have an observer with the necessary training and with the necessary supply of mice; otherwise it presents no great difficulty. By the kindness of my colleagues, Professor Crew and Dr. Wiesner in the Animal Breeding Research Department, we established in the University of Edinburgh in January, 1929, a Pregnancy Diagnosis Station, and by means of letters in the leading medical journals I was able to offer to the medical profession all over Great Britain and Ireland the opportunity of having urine tested in this way for a very modest fee, which only just covered the actual expenditure. The response has been very gratifying, and is of itself an indication of the real need for a reliable test of early pregnancy. Our work, it will be noted, has not been aimed so much at testing the specificity of the reaction, as at trying it out as a practical addition to our diagnostic methods, although one which is admittedly subject to a very small margin of error. In regard to the question of specificity, the experience of Zondek and Aschheim, of Brühl, and of others, suggests that occasional positive reactions may be obtained in cases of newgrowths, particularly malignant growths, and in inflammatory conditions, such as cystitis or vaginitis. In view of the well-known association of the pituitary gland with somatic and skeletal growth, this observation is interesting. Positive reactions have been obtained in pregnancy as early as thirty days after the last menstruation. Negative results in spite of the existence of pregnancy are more common in the early weeks than after the fourth month; and probably many cases in which a negative result is believed to be erroneous might be rectified by a second test. Tubal pregnancies give a positive reaction in the majority of cases, but not in old-standing cases of tubal mole, in which the trophoblast is largely destroyed or degenerated. Hydatidiform mole gives, as might be expected from the excess of trophoblastic epithelium present, a strongly positive result even with unusually small quantities of urine. Chorionepithelioma, according to Zondek and Aschheim, gives a positive reaction.

The results of our work in Edinburgh show the practical value of the test in an entirely unselected series of cases in which pregnancy was suspected. Between January and July, 1929, we received from all over Great Britain and Ireland 360 specimens of urine. Two months after the result was notified to the doctor, a letter was sent asking whether the subsequent clinical course of the case confirmed the result of the test or otherwise. Up to the end of August we had re-

ceived 152 such replies. Fifty-seven results were negative, 90 were positive, and in 5 we were in error. Of these 5 errors—in 1 instance a repetition of the test, a month later, revealed the true state of affairs. In another the history given us was such that although the doctor said we were wrong, I have my doubts and would like to hear from him in another six months. But at the worst our error was apparently 3.3 per cent and I am rather inclined to think it should really be read as 2 or 2.5 per cent.

I would like to refer in detail only to one erroneous result which occurred in connection with my own private practice because it illustrates what I may call the irony of fate. The patient was a woman thirty-seven years old, on whom I operated in March, 1927. She had then had two children and two miscarriages which were attributed to myocardial disease. For more than a year she had suffered constant pain from a very tender, enlarged left ovary, which would have been removed earlier but for the serious condition of her heart. When she was sent to me, her heart had improved; and I operated and removed the diseased left ovary and tube. I also—and this is the first point—"sterilized" her by resecting three-quarters of an inch of the remaining tube at the uterine end and burying the stumps between the layers of the broad ligaments. Twenty-six months later she missed a period. Examination showed a very slight enlargement of the uterus, but there were no subjective symptoms of pregnancy. I was disposed to scout the possibility of a pregnancy, but obtained a specimen of urine for the test. The test was made forty days after the last menstruation, and was definitely negative. Fifteen days later she aborted and expelled what her doctor thought was approximately an eight weeks' embryo.

The duration of pregnancy and the cause of the onset of labor are two other obscure problems upon which I think these new researches shed some light. It is now generally accepted that, as was first indicated by Fraenkel, the continuance of pregnancy in the early months depends upon the presence and functioning of the corpus luteum. The work of Crew and Wiesner enables us to assert that it is dependent upon the formation of the beta hormone by that body; and as the activity of the lutein cells appears to be stimulated by the rho II factor from the anterior lobe of the pituitary, we can trace the responsibility for the duration of pregnancy back to the pituitary gland. But having done so, we find, as is so often the case in the complex functions of the human organism, that the trail can be pursued round in a curve to a point near our starting place. For we saw previously that there was some ground for supposing—or at least speculating—that the activity of the anterior lobe of the pituitary was maintained by the stimulus of a hormone formed by the trophoblast of the ovum. Thus, the circle completes itself; the safe continuance of the trophoblast in the uterus depends on the function of the corpus luteum: that in turn depends on the function of the anterior pituitary lobe: and that again depends, or may be found to depend, on the functioning of the trophoblast.

Now, if some such circular mechanism is found to be the correct explanation of the duration of pregnancy, it is obvious that the circle must be broken somewhere in order to interrupt the continuance of pregnancy. On this point I venture to throw out the suggestion that possibly the break is brought about by the gradually increasing senile changes in the trophoblast of the ovum. These changes are familiar to us all: the disappearance of Langhans' cells about midterm, and the gradual thinning out of the syncytium and latterly the degenerative changes which occur in it toward term. Such changes may well bring it about that the trophoblast in the later weeks ceases progressively to give the anterior pituitary lobe the requisite stimulus to the formation of the rho II factor (or ceases to produce the rho II factor itself), and thus lead directly to a shortage in the beta hormone of the corpus luteum. If further research should prove the correctness of this speculation, it will be another instance of how modern research serves but to explain views which were held speculatively at a much earlier date; for it is thirty years since Eden made a somewhat similar suggestion, based upon his researches on placental infarcts. This speculative theory of mine has this point in its favor—that it brings the onset of labor into parallelism with the casting off of the menstrual decidua at the end of a pseudopregnancy, for, as we have seen, that also is apparently due to the cessation of the beta hormone of the corpus luteum. Admittedly and indeed probably this is not the whole story. The familiar action of the extract of the posterior lobe of the pituitary gland is such as to make it extremely likely that it will be found to have some rôle to play in the drama in connection with the uterine contractions of labor, and possibly also of menstruation. Furthermore, there is a degree of apparent antagonism between the actions of the alpha and beta ovarian hormones which suggests the possibility that they dominate the situation alternately, and that as the influence of the one wanes, so the dominance of the other waxes greater. Wiesner has succeeded in producing abortion in the early weeks of pregnancy in experimental animals by the injection of alpha or estrin. I have tried by the same means to interrupt pregnancy in the human subject in normal cases near full term, and in others in whom the premature interruption of pregnancy was therapeutically indicated, and I have failed.

The problem of abortions, which occur without recognizable cause, is in some degree covered by what has just been said. Ever since Fraenkel pointed out the necessity of the corpus luteum for the safe continuance of pregnancy at least in the early months, efforts have been made to treat cases of threatened abortion and more particularly of habitual abortion by the administration of extract of the corpus luteum. We may now legitimately conclude that some of these cases are due to the inadequate supply of beta hormone from the

corpus luteum; and that failure may possibly be traceable to insufficient rho II from the pituitary. Pure speculation might even carry us one step further and propound the question whether the failure of the pituitary might not in its turn be due to the trophoblast of the young ovum not giving rise to the necessary stimulation of the pituitary. but without going so far as that, it is obviously rational to hope that the future may reveal a fruitful line of treatment either by the injection of the beta hormone of the corpus luteum, or possibly by the stimulation of the pituitary body or the injection of extracts containing the rho II factor.

I have referred to the fact that Zondek and Aschheim have found that in cases of hydatidiform mole the rho factors are present in excess in the urine; and I have ventured to link that observation with the excess of trophoblast present in that condition. It has another bearing of interest, namely, that the excess of the rho factors may well be the explanation of the lutein cysts which are so often found in the ovaries of women who have a hydatidiform mole. Lastly, Aschheim found that the urine of a woman with chorionepithelioma gave a positive reaction to the Zondek-Aschheim test, and has made the valuable suggestion that after a hydatidiform mole the urine of the woman should be tested from time to time, as any growth of retained fragments of trophoblastic epithelium might well be expected to reveal itself in a positive reaction. This strikes me as a very valuable diagnostic hint in regard to a condition of the greatest gravity.

I pass now to a brief consideration of the possible implications of this new view of the cause of menstruation upon the disorders of that function. The discovery and isolation of the alpha or estrin hormone of the ovary has led to its production commercially and to its widespread employment in *amenorrhea*, but I have not seen any scientific records of its having proved a success in so far, at least, as primary amenorrhea is concerned. I have tested it out in my ward in several cases of young women from seventeen to twenty years old, who had never menstruated, and in whom careful examination revealed no anatomic defect in uterus or ovaries; and I have used both commercial extracts and extracts supplied to me by Wiesner, which were, as tested in mice, vastly more potent than any product upon the market. The results have been disappointing in the sense that menstruation has not been produced; but, on the other hand, we must ask ourselves if there was any real reason to expect that menstruation would follow. For menstruation is the termination of a pseudopregnancy, and for the full development of that phenomenon both the alpha and the beta hormones are needed. What did happen in my cases, which were carefully watched over periods of several months, vaginal smears being made every second day, was that the injection of alpha (estrin)

produced some degree of cornification of the vaginal epithelium—an estrual change, be it noted, and not one associated with pseudopregnancy or menstruation—and that in one or two instances there was a little blood in the cervical mucus. In other words, the alpha or estrin injection produced an artificial or pseudoestrus in these patients, but nothing of the nature of a real menstruation. I hope in the future to be able to repeat these clinical experiments, using not only alpha, but following it up with beta, along the lines which this new physiology indicates.

In one or two cases of secondary amenorrhea, not due to any recognizable medical condition, I have achieved a modified degree of success with alpha, which suggests that it may occasionally succeed in starting the mechanism in an ovary which is functionally inert. But unless the injections are repeated monthly, the function ceases, and this indicates a very important principle; namely, that the hormone is apparently substitutive only and not stimulative in its effects; that is to say, that it may for the moment take the place of the normal product, but does not really stimulate the ovary to resume its own production.

Another method of treatment which is being tested at various centers, and which is closely linked up with the new physiology, is the stimulative irradiation of the pituitary body by x-rays. This seems a natural enough method, but most assuredly it is not one to be indiscriminately employed, for the effects of the rays once applied are beyond recall, and the slightest overdose may do far more harm than good. Moreover, it must be borne in mind that our new physiology teaches us that the pituitary body, the rho I and the rho II factors, cannot act in the way desired except through ovaries capable of reacting in the production of the alpha and beta hormones, and Wiesner has found that in the lower mammals the capacity to react varies enormously in the ovaries of different individual animals, and even in sister animals of the same litter.

The conclusion of the whole matter would therefore appear to be that the cause of amenorrhea is a very complex affair, and that its cure will have to be something that will activate the whole triangular mechanism of the pituitary, the ovary, and the uterus.

With regard to menorrhagia I propose to say very little. It is too vast and too complex a topic. I would merely point out that it has long been held on clinical grounds that some cases of excessive menstrual flow from uteri which presented no gross pathologic change were attributable to excessive ovarian action, and have even been treated successfully by removal of part of the ovaries. In the light of our present knowledge this observation may be interpreted as an excess of alpha or estrin which, when injected in large doses into

experimental animals, produces an intense and abnormally prolonged congestion of the uterus. This in turn is presumably due to an excess of the rho I factor from the anterior pituitary lobe. Quite possibly future research may enable us to complete a vicious circle in this connection, and to link up the excessive action of the pituitary to the condition of the endometrium; but of that I have no present evidence.

Dysmenorhea of the true or intrinsic type, due to uterine colic, may be regarded as the pains of a spurious labor terminating the pseudopregnancy. But such a conception does not at present seem to lead us much further in regard to treatment. Beckwith Whitehouse has suggested, and brought forward some evidence to show, that dysmenorrhea is due to difficulty in the disintegration of the surface layers of the menstrual decidua. He believes that the transient exacerbations of the pain, which are so characteristic, are associated with the passage of abnormally large flakes of endometrium, and that what is usually called "membranous dysmenorrhea" is really just an extreme form of the process which causes the pain in the more ordinary cases. I have repeated Whitehouse's observations in detail on several cases in my own wards, but have been unable to confirm them. Nevertheless his views are suggestive, and one can speculate that for the easy and painless disintegration of the menstrual decidua into such small cellular fragments as could painlessly pass through a possibly stenosed cervical canal, a nice adjustment would be required in regard to the supply of the beta hormone, which produces the premenstrual changes, and in the time of its cessation of action; and that a disharmony in this mechanism might be responsible for the clinical phenomena of dysmenorrhea. Again, however, all that is purely speculative at present and is probably not the whole story. I refer to it merely in order to throw out a hint as to further lines of clinical research.

Lastly, may I just touch on one other baffling problem, namely, sterility. It is well known that some cases of sterility, for example, in cows, are due to a persistent corpus luteum, and may be successfully treated by the manual expression of the corpus luteum by the hand in the rectum. We have no actual proof that such a condition occurs in women, but some cases of female sterility associated with amenorrhea may be susceptible of such an explanation, and, if so, the condition is presumably due to excessive or uninterrupted secretion of rho II by the pituitary. More difficult are the cases where the woman menstruates regularly and no cause can be found in either partner to the marriage for the failure to conceive. My old master and predecessor, Sir Halliday Croom, held that some of these cases were instances of monthly abortions. Now that we know the essential rôle played by the rho II hormone from the pituitary and the beta hormone from the corpus luteum in the preparation of a proper nidus for the fertilized ovum in the uterus, it is possible to speculate that

too little rho II and consequently too little beta may make the preparatory changes in the uterus so inadequate that although a fertilized ovum is there, yet it is unable to embed itself securely; and that in such cases menstruation is not merely the abortion of an unfertilized ovum, but of a fertilized ovum.

REFERENCES

(1) *Wiesner and Patel:* Nature, March 23, 1929. (2) *Crew and Wiesner:* Proc. Roy. Soc. Edin., 1929; see also Nature, Dec. 22, 1928.

THE TIME OF OVULATION IN THE MENSTRUAL CYCLE AS CHECKED BY THE RECOVERY OF OVA FROM THE FALLOPIAN TUBES

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HERETOFORE the time of ovulation in the menstrual cycle has been computed chiefly from studies of recent corpora lutea; i.e., the remnants of mature graafian follicles after the ova have been extruded. Very little is known about the human ovum from just before the time of ovulation until the embryo has implanted in the uterus. We are unable to find in the literature work describing the recovery and definite identification of a normal human ovum from the fallopian tubes. There is mention of such a possibility by Letheby,[1] Hyrtl,[2] Hoehne,[3] Poten,[4] and Gassman.[5] After a critical study of the cases reported by these investigators we are inclined to doubt if their specimens were unfertilized tubal ova. A full discussion of these specimens will be found in a detailed report now in press.[6] Corner[7] and Allen[8] have recovered unfertilized ova from the tubes of monkeys. This success suggested a similar possibility in women which would supply definite evidence concerning the time of ovulation in the menstrual cycle.

Until a few years ago it was thought that ovulation and menstruation occurred simultaneously, but from recent studies of corpora lutea in women, Schröder[9] and others have concluded that ovulation takes place during the intermenstrum, probably from the fourteenth to the sixteenth day of the menstrual cycle. In the present work we have correlated the menstrual history in women with careful gross and microscopic observations of the corpus luteum and have attempted the recovery of the corresponding ovum from the fallopian tube.[10, 11]

The main part of the work consisted of operating upon patients on different days of the menstrual cycle and, in cases where the ovum had been extruded, irrigating the fallopian tubes. Then the most recent corpus luteum was removed for histologic study and for quantitative analysis of hormone content by injections or implants into ovariectomized rats. In those cases in which it was not necessary to remove the fallopian tubes, they were irrigated with normal saline solution by a special technic of clamping the lower segment of the uterus with special uterine forceps, the tips of which were covered with rubber tubing so as not to injure the uterus, injecting about 20 c.c. of the solution into the uterine cavity through the wall of the fundus with a syringe and small caliber needle while the assistant with thumb and forefinger compressed the opposite tube at the uterine end as the other tube was being irrigated. The washings were collected in several small watch glasses and carefully searched for ova. This irrigation method is also useful in testing the patency of the tubes when the abdomen is opened. A detailed description of the technic with a drawing of the necessary instruments will be published later. In cases where the tubes were removed they were irrigated separately from either the uterine or fimbriated end. Where possible, ova were fixed, embedded in paraffin and sectioned for cytologic study. This is necessary for definite identification of tubal ova when they are surrounded by follicle cells, for one often finds small masses or balls of cells which are sometimes difficult to distinguish from ova.

The material has been selected from routine operations. Therefore, the amount of suitable material was greatly limited. In many of the cases operated upon, the pathology involving the pelvic organs was so extensive that the material was unfit for study. The best specimens were obtained from cases of myoma uncomplicated by pelvic inflammatory disease or cystic ovarian formations. In a few patients who were approaching the menopause, it was necessary to remove the uterus, and both tubes and ovaries. Also in cases of retrodisplacement in young women where no pelvic inflammatory disease existed to cause obstruction of the tubes, the tubes were irrigated in situ, the washings collected from the fimbriated extremity of each tube in a series of watch glasses and carefully searched for ova. Among the pathologic conditions encountered were closed fimbriae of the tubes due to old peritonitis or pelvic cellulitis, or the patient had had a previous attack of appendicitis and the tubes had been sealed (club ends). Many of the myoma cases were in negroes and adhesions throughout the pelvis were common. In some cases in which recent ovulation had occurred the sealed ends of the tubes made the passage of the ovum into the uterus impossible. Another obstacle of great importance that we encountered was the timing of the operation according to menstruation. It is surprising how few women keep accurate data pertaining to their

menstrual periods. This resulted in many cases that were suitable for study but had not recently ovulated. Also we had to consider possible irregular ovulation due to such conditions as occupational interferences, shock, constitutional diseases, or possibly marital relations. When all these factors are considered the search for tubal ova is difficult and often very disappointing and requires considerable patience and persistence to carry on the work.

In cases where the ovaries were removed it was easy to obtain the most recent corpus luteum. In cases where the ovaries did not warrant removal, as in cases where the tubes were irrigated in situ, the most recent corpus luteum alone was removed from the ovary. The stage of development of the corpus luteum was studied histologically in each case.

More than ninety operations were performed at various stages of the menstrual cycle. The greatest number of operations were performed between the twelfth and sixteenth day of the menstrual cycle (dated from the first day of previous menses), others ranged from the first to the twenty-fifth day. The most suitable material was obtained at operations occurring near the middle of the cycle (intermenstrum). From the above number of operations, nine specimens were recovered from the fallopian tubes which at first examination while fresh in saline solution were thought to be ova. Five of these were definitely identified after sectioning as tubal ova. One, on section, proved to be a "cell ball." It is possible that three specimens were degenerating ova, but definite identification after sectioning was not successfully accomplished. The common occurrence of "cell balls" in washings from the tubes increases the possibility of error in identification unless the specimens are sectioned. The so-called "cell balls," if not degenerating ova, may be clumps of cells originating from the peritoneal cavity or the fimbria of the tube or may be derived from the endometrium of the uterine cavity and forced out through the tubes in the process of irrigating the uterine cavity and tubes.

Corpora lutea showing fairly recent rupture points, as judged by gross examination of the ovaries at operation, occurred in more than 30 cases. Although upon a gross examination some of these corpora lutea appeared to be recent, on histologic examination a few proved to be fairly well developed. There were at least 16 cases which from a microscopic study of the corpus luteum, might have had an ovum in the corresponding tube. From these only five specimens which could be identified with certainty as ova were obtained. Of course involvement of pathologic conditions would lower the expectancy. Several promising cases had to be excluded because of adhesions of the ovary or occluded fimbriated ends of tubes due to old inflammatory disease.

Of the five specimens definitely identified as tubal ova, the first was recovered on the fifteenth day of the menstrual cycle (after onset of

the previous menses). The operation was for retrodisplacement of the uterus. A Gilliam-Crossen shortening of the round ligaments was performed. The tubes were irrigated in situ. A recent corpus luteum was resected from the right ovary. The second and third ova were twins recovered on the fifteenth day of the menstrual cycle. The operation was for myoma of the uterus. Supravaginal hysterectomy with double salpingo-oophorectomy was performed. Each ovary contained a corpus luteum with recent rupture point. Both tubes were dissected free from the myoma and washed out and an ovum was recovered from each tube. The ova were similar. The fourth ovum was recovered on the sixteenth day of the menstrual cycle. The operation was for chronic subinvolution of the uterus, endometrial implants

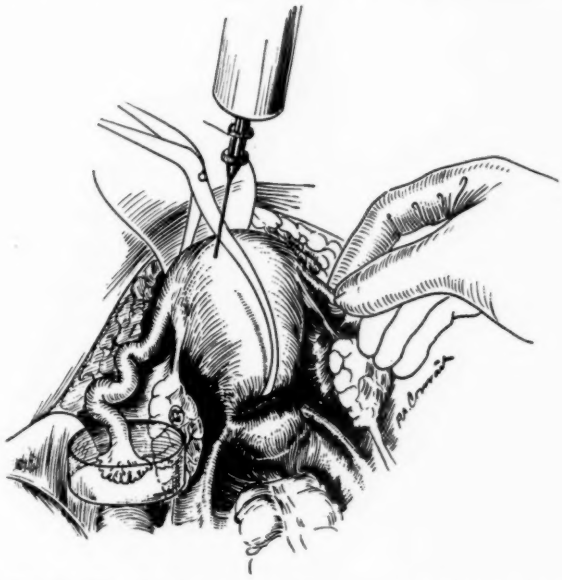

Fig. 1.—Drawing showing method of irrigating the fallopian tubes in search of ova. This method is also useful in testing the patency of the tubes when the abdomen is opened.

of the sacro-uterine ligaments and varicose veins of both broad ligaments. A complete hysterectomy with left salpingo-oophorectomy and appendectomy were performed. The tube was dissected free and washed out and an ovum recovered. The most recent corpus luteum was obtained in this case. The fifth ovum was recovered on the fourteenth day of the menstrual cycle. The operation was for chronic subinvolution of uterus and lacerated cervix. Hysterectomy with right salpingo-oophorectomy was performed, the recent corpus luteum being obtained from the ovary removed. The tube was irrigated and an ovum recovered.

Of the other specimens which were not identified with certainty as ova, one was recovered on the fifteenth day and two on the sixteenth

day of the menstrual cycle. A recent corpus luteum was found in each case. It is possible that these may have been degenerating ova but since definite identification was not successfully accomplished in sections it seems preferable to exclude these cases. The specimens mentioned here have been described fully in a publication now in press[6] which should be referred to for details of cytologic description. In another paper[12] we stress especially the difficulty of timing the operation in regard to the menstrual history and the gross appearance of the ovary at operation.

From facts obtained from a study of the five unfertilized tubal ova, ovulation takes place on, or one or two days before, the fourteenth (morning of the fifteenth) day following the onset of the previous menses. It is, of course, possible that with the additional stimulus of intercourse ovulation might be induced at other times in the cycle. The time at which fertilization of the ovum takes place and the time during the menstrual cycle when a woman may be sterile is of considerable clinical importance. Apparently the ovum will have completely degenerated after the twenty-first day of the menstrual cycle and whether in the tube or the uterine cavity would probably be incapable of undergoing fertilization. From our data it seems probable that fertilization of the ovum takes place between the twelfth and fourteenth (morning of the fifteenth) day of the menstrual cycle. This does not mean that a woman must be exposed to intercourse only at that time to become pregnant. It has been shown that spermatozoa may live for some time in the female generative tract (the length of life depending on many factors) and no doubt in many instances the spermatozoa are lying in wait in the tube for the ovum when it is extruded so that it is fertilized soon after ovulation. If fertilization does not take place within a relatively short interval, the ovum undergoes rapid degeneration and there is little chance of conception until the next intermenstrum.

SUMMARY

1. More than 90 patients were operated upon and 9 specimens were recovered from the fallopian tubes, 5 of which were successfully sectioned and definitely identified as tubal ova.

2. A method of irrigating the tubes in situ was devised which we believe to be safe and which makes available cases where tubes showed no pathology and therefore were not to be removed. The method is useful to determine the patency of the tubes in cases of obstruction when the abdomen is open and plastic work has been done.

3. In this series of cases the time of ovulation was on, or one or two days before, the fourteenth (morning of the fifteenth) day following the onset of the previous menses.

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REFERENCES

(1) *Letheby, H.:* Phil. Trans. Roy. Soc., pp. 57-64, 1852. (2) *Hyrtl, J.:* Ztschr. f. rationelle Medizin, Neue Folge **4:** 1854. (3) *Hoehne, O.:* Zentralbl. f. Gynäk. **45:** 1047, 1048, 1921. (4) *Poten, W.:* Zentralbl. f. Gynäk. **46:** 1490, 1922. (5) *Gassman, O:* Zentralbl. f. Gynäk. **49:** 393, 1923. (6) *Allen, E., Pratt, J. P., Newell, Q. U., and Bland, L. J.:* Contrib. Embryol., Carnegie Pub. (in press). (7) *Corner, G. W.:* Carnegie Inst. Wash. Pub. **15:** 75-101, 1923. (8) *Allen, E.:* Anat. Rec. **37:** 351-356, 1928. (9) *Schroder, R.:* Arch. f. Gynäk. **101:** 1-35, 1913; Arch. f. Gynäk. **104:** 27-102, 1915. (10) *Allen, E., Pratt, J. P., Newell, Q. U., and Bland, L. J.:* J. A. M. A. **91:** 1018-1020, 1928. (11) *Ibid:* Anat. Rec. **42:** 2, 1929. (12) *Pratt, J. P., Allen, E., Newell, Q. U., and Bland, L. J.:* J. A. M. A. **93:** 834-837, 1929.

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REPAIR OF COMPLETE PERINEAL LACERATION

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THE distress caused by complete perineal laceration is of much concern, both to patient and physician. Although this injury is seen perhaps less frequently than in former years, it is a possibility in every obstetric delivery. The small series of cases herein reported show eight complete tears following spontaneous delivery, four of which occurred in multiparae. The many varied attempts at repair is evidence of the lack of agreement in a method that is universally satisfactory. Phaneuf reports a series with few failures, but his excellent results are no doubt due to the unusual ability of the operator, since his was a one-man series.

The stimulation of useful constructive criticism of the various repair methods employed would seem to be of the greatest practical value to the operator of *average* ability. The majority of patients with complete perineal laceration are first treated by operators coming within this class.

With this hope, I have studied every patient operated upon for complete perineal laceration in Barnes Hospital and the new St. Louis Maternity Hospital. Three additional private patients operated upon in St. Luke's Hospital are included in this series, which comprises a total of 62 patients and 68 operations, performed by 13 different operators, all connected with the same teaching institution. The material is thus fairly representative and the nursing care fairly uniform in all cases, hence average results might be expected. All patients had tears through the sphincter ani and rectal wall which occurred during childbirth. Four of the patients were definitely syphilitic. Two of the patients were operated upon a second time, and two others had three operations following previous failures.

Different individuals have different means of arriving at the same end, and the technic employed by any particular operator doubtless gives better results in his hands than would obtain by his using methods commonly employed by others.

It is fully recognized that there are a large number of different factors that may influence the results obtained in repair operations, yet the *general average result* in such a study as this is significant. In order to try to evaluate some of the factors that might help or hinder a larger number of successful results, I shall show in tables the main differences in procedure.

Table I shows the forces concerned in etiology. It is interesting to note that among 62 patients in this series, complete perineal laceration followed spontaneous delivery eight times, of which four were in primiparous and four in multiparous labors.

TABLE I. COMPLETE PERINEAL TEARS, ETIOLOGY

	WHITE	COLORED	
Delivered by forceps	26	3	29
Delivered by breech	2	2	4
Delivered by version	3	1	4
Spontaneous delivery	7	1	8
Method of delivery not stated	16	1	17
Totals	54	8	62

Table II shows the results obtained in relation to suture material used in operation. There were 25 primary or immediate repair operations and 43 secondary or old repair operations. Results are classified as: 1. "Primary union with perfect function" when there was no visible wound moisture or slough of any degree whatsoever; 2. "Secondary union with perfect function" where perfect sphincter function and no visible leakage of any sort were present at time of discharge from the hospital, although any wound moisture, discharge or slough, however superficial, placed such a case as one with "secondary union." 3. "Secondary union with imperfect function" comprised all cases with any visible leakage or sphincter control less than perfect at the time of discharge from the hospital. Several of the cases so classed left the hospital with good sphincter control and a granulating rectovaginal fistula, which may or may not have become fully closed later.

The final results following the use of linen and silk are better than I had expected from this very popular method. An operation which depends upon a certain amount of sloughing of sutures in a field so difficult to keep clean as the rectum, seems a good opportunity for a fistula. Among the 10 cases where silkworm stay sutures were used, 6 left the hospital with imperfect function and secondary union. This small series with 60 per cent failures would indicate the risk of using this type of suture. The chart also shows a better final result follow-

TABLE II. RESULTS OBTAINED IN RELATION TO SUTURE MATERIAL

	PRIMARY REPAIR	SECONDARY REPAIR	LINEN	SILK	SILKWORM		INTERRUPTED CATGUT				CONTINUOUS CATGUT		TOTAL OPERATIONS
					ALONE	STAY SUTURE	2-40	1-40	2-20	1-20	1-20	PLAIN	
Primary union Perfect function	12	13	4	4		1	3	2	7	1	3	7	25
Secondary union Perfect function	7	19	5	3	1	3	7	0	8	2	3	5	26
Secondary union Imperfect function	6	11	1	2		6	6	1	8	2			17
Total	25	43	10	9	1	10	16	3	23	5	6	12	68

ing the use of smaller and more quickly absorbable catgut with few knots than in the heavier varieties with interrupted sutures. This is shown most markedly in the 16 cases operated upon with the continuous catgut, No. 1-20 day or plain No. 1 or No. 0 catgut, with perfect final results in every case. No other type of operation in this series could equal this result and the method was employed by several different operators, hence, there could be no claim for superior technical skill.

Table III shows the results obtained in relation to the first defecation after operation. Among 6 patients with spontaneous defecation during the first four days after operation, 2 had primary union and 4 had secondary union with imperfect function, while not one of the 4 had a primary union where defecation during the same early period

TABLE III. RESULT IN RELATION TO FIRST POSTOPERATIVE DEFECATION

DEFECATION FROM	P. O. DAY	PRIMARY UNION, PERFECT FUNCTION	SECONDARY UNION, PERFECT FUNCTION	SECONDARY UNION, IMPERFECT FUNCTION	TOTAL
	1-4	2	0	4	6
	5-7	0	2	0	2
Spontaneous	8-10	0	0	0	0
	11-15	1	1	0	2
	16-23	0	0	0	0
Total		3	3	4	10
	1-4	0	3	1	4
	5-7	3	3	1	7
Enema	8-10	2	3	2	7
	11-15	2	2	3	7
	16-23	0	0	1	1
Total		7	11	8	26
	1-4	3	1	2	6
	5-7	2	1	1	4
Laxative	8-10	1	2	1	4
	11-15	9	7	0	16
	16-23	0	1	0	1
Total		15	17	4	31
Not recorded	1-4	0	0	1	1
Total		25	26	17	68

resulted from enema. The best results were obtained in twenty-seven with perfect function among 31 patients where defecation resulted solely from laxatives.

The postoperative diet was almost universally liquid, or liquids without milk, for seven days or longer. It is recommended that this latter diet be continued until after the wound is well united or symptoms of autointoxication occur. Such symptoms of autointoxication are: coated tongue, malaise, abdominal distention, dull headaches, possibly slight nausea, or slight rise in temperature. The laxative then recommended is mineral oil, 30 c.c., three times daily for two days, followed by a bottle of citrate of magnesia given in divided doses. The desirable time for the first defecation seems between eleven and

fifteen days after operation. In two cases the first defecation occurred twenty-three days after operation. Any local manipulation, whether from enema or rectal tube, would seem more likely to traumatize the wound, since among 26 patients where the first defecation resulted from the use of an enema only 7 of them had a primary union.

Table IV shows the result obtained in relation to preoperative preparation. "Routine preparation" means the customary liquid or soft diet and a laxative, with or without an enema, the day before operation, and an enema on the morning of operation. "Special preparation" embraces liquid diet, laxatives, and enemas for two successive days before operation, and an enema on the morning of operation. This "special preparation" makes it much easier to postpone the first defecation following operation. The figures show that the best results followed the latter; 11 out of 13 patients with perfect function as compared with only 20 out of 30 following "routine preparation." Comparison could only be made in the secondary operations, as all primary repairs were performed on patients who had had only the ordinary

TABLE IV. RESULTS OBTAINED IN RELATION TO PREOPERATIVE PREPARATION

	SECONDARY REPAIR	ROUTINE PREPARATION	SPECIAL PREPARATION
Primary union with perfect function	14	10	4
Secondary union with perfect function	17	10	7
Secondary union with imperfect function	12	10	2
Total	43	30	13

preparation for delivery, which included at most only a low enema, and, in a few cases, castor oil for induction purposes.

The method of repair preferred is shown on a primiparous patient where a midline episiotomy extended through into the rectum during delivery. A Doyen vaginal retractor and a Gelpi self-holding retractor are used to expose the wound without any crushing trauma with forceps. In secondary repairs, a deep silkworm suture is passed through each levator, as high up in the vagina as possible, before beginning any dissection. These silkworm sutures, clamped separately, are used only as halters to help identify the levators when beginning to suture same.

1. Closure of rectal wall by a continuous Lembert suture of No. 0 or No. 00 plain catgut, with a small curved needle on each end. The suture begins in the muscle *above* the apex of the tear and ends in the anal skin superficial to the sphincter ani.

2. The other end of the suture approximates the perirectal tissues over the first line of suture. Using a continuous Lembert suture the rectal wound is thus closed in two layers. No suture penetrates the rectal wall and there are no knots

buried or anywhere in contact with the rectum, the two ends of this suture being tied outside through the anal skin and constituting the lowermost perineal suture outside the skin, as indicated by arrows.

3. The rectal wound has been closed in two layers with ends shown not yet tied. The sphincter ani is now united by a deep suture through the inner third.

4. Two No. 1 plain catgut sutures, preferably mattress or simple interrupted sutures, are carried through the outer third of the sphincter ani and now approxi-

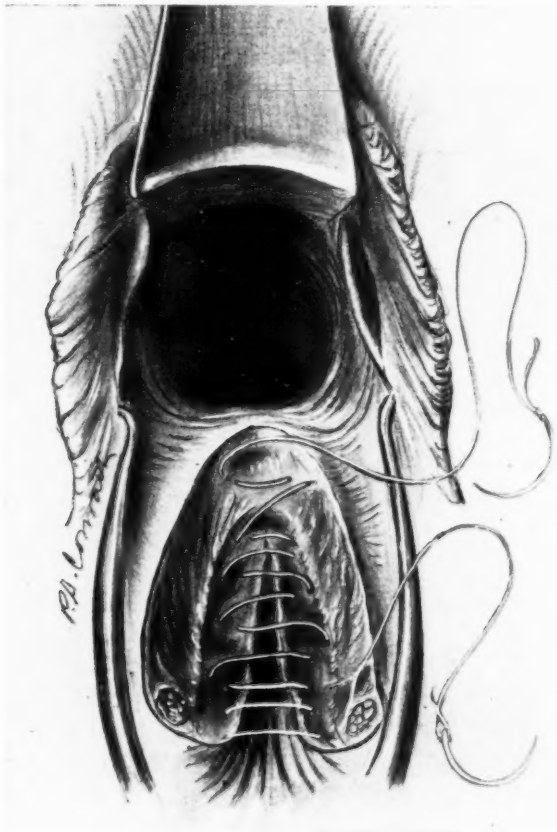
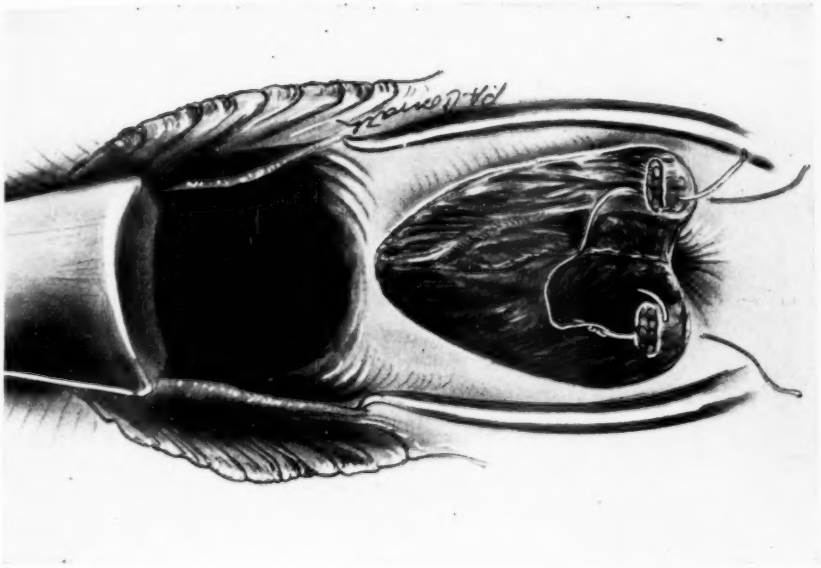


Fig. 1.

mate the margins of the latter. The knots are placed on opposite sides away from the line of union. Note the free ends of the sutures used to close the rectal wound.

5. A full length No. 1 plain catgut suture is introduced longitudinally deeply in one side of the muscular layer, parallel with the longitudinal direction of the vagina; it is then brought out and carried across the midline and inserted at a right angle to its previous direction, emerging immediately below the vaginal mucosa near the upper angle of the wound. This suture is laid aside upon the abdomen to be used as a superficial submucous closure. The other (deeper) end of the suture threaded is used to approximate the deeper muscular layers and is brought through the skin, as indicated by arrows, to form the second lowest suture tied on the skin surface.



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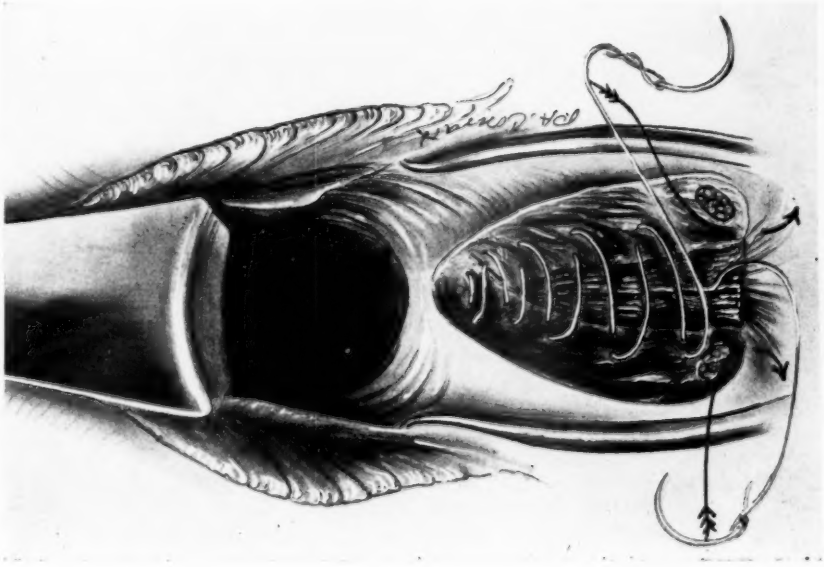

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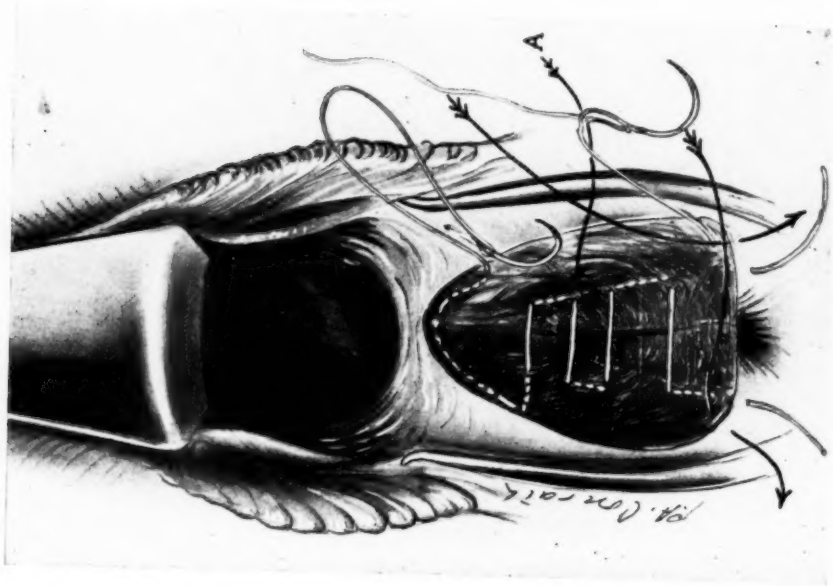

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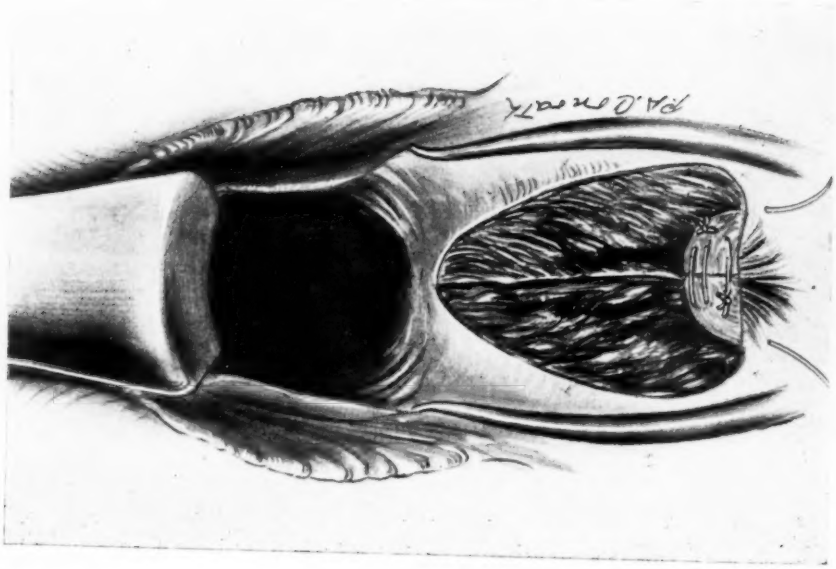

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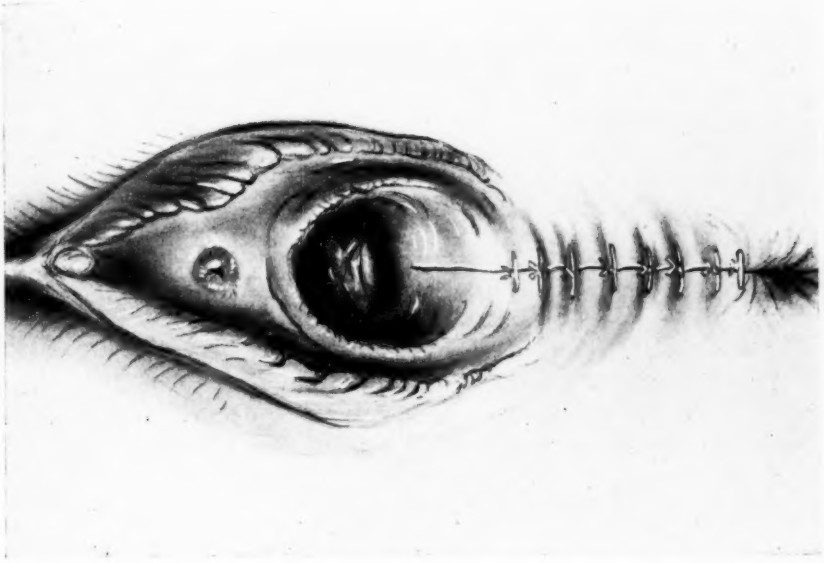

Fig. 7.

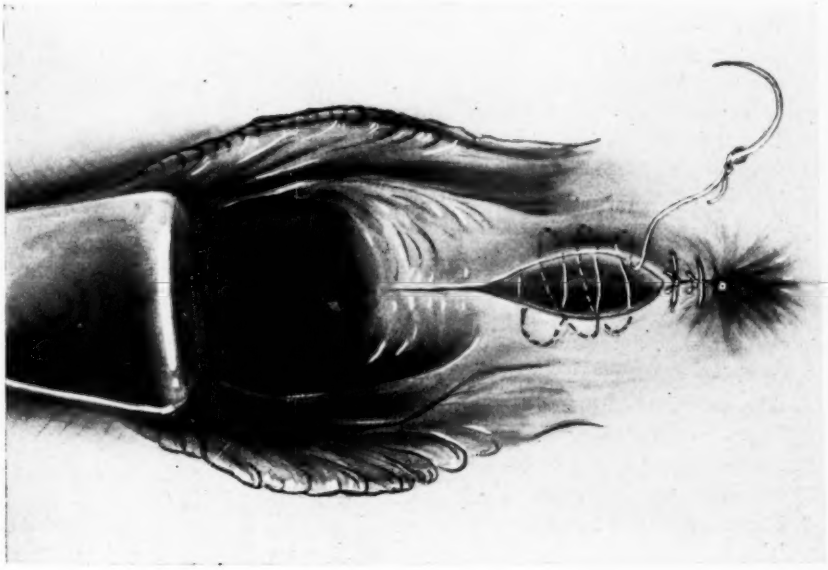

Fig. 6.

6. The continuous sutures described above have now been tied and the more superficial layer of continuous No. 1 plain catgut has approximated the vaginal wound by a submucous suture. This suture carried widely on either side at the mucocutaneous juncture closes the introitus and prevents gaping. The two or three deep muscular bites over the base of the perineal triangle from above down obliterates dead space and the suture is cut short without tying.

7. The skin wound is then closed with superficial sutures of No. 1 plain catgut, interrupted or continuous in primary repairs, but preferably interrupted in secondary repairs, with knots being more to one side of the line of repair than is shown in the picture.

All knots used in this operation are visible excepting the two or three knots approximating the sphincter.

It is recognized that this method of suture is too complicated to enjoy any widespread popularity. It requires an extra assistant in order to complete the operation as quickly as when using a simpler method. The advantages claimed are: A more complete approximation of the tissues, less pain to the patient, and lessened liability to pressure necrosis than by any other method that I have used.

SUMMARY AND CONCLUSIONS

Prophylaxis is, of course, first in importance. Among the prophylactic measures advised are:

1. Follow the normal mechanism of labor.

2. Iron out the pelvic floor slowly and gently with liquid soap prior to delivery. The lower position of the thighs during delivery, as recommended by Potter, is desirable.

3. Digital stretching of the sphincter ani *before* delivery in cases of suspected disproportion, narrow bony outlet, and especially in abnormal presentations, including breech deliveries.

4. The mediolateral incision in the perineum in such cases as those just mentioned and in primipara with low perineum (less than 1½ inches high) where disproportion is suspected.

As curative measures, I would suggest the following aids in secondary repair:

1. Special preoperative preparation by diet and elimination for two successive days prior to operation in secondary cases.

2. Excision of all cicatricial tissue along line to be sutured.

3. Absolute freedom from tension along suture line of union (in this connection, dissection on each side of the rectum is of great value).

4. No suture anywhere within the rectal lumen.

5. No suture *knot* anywhere in contact with the rectal wall.

6. Use a small running (continuous) suture of No. 0 plain to No. 1-20 day chromic catgut throughout the entire operation, bearing in mind the principle of surgical pathology that if a primary union has not occurred within six or seven days after operation, there will be none, and that sutures lasting much longer than this time act as irritants and only too frequently cause pressure necrosis, especially at the site of knots.

7. Only a continuous Lembert suture of fine plain catgut is recommended for closing the rectum.

8. The same type of suture has given me equally good results in approximating the sphincter in primary repairs, although in secondary operations it is recommended that the sphincter ani be stretched prior to the denudation, as recommended in Crossen's *Operative Gynecology*, and then the ends sutured by the fewest number of interrupted sutures that will approximate same.

9. The use of all crushing instruments, or even the Allis forceps, is discouraged, a deep bite of the needle being equally effective and less traumatizing. Instrumentation should be reduced to the minimum.

10. Knots should be few in number and tied barely tightly enough to make contact of the sutured wound margins.

11. Postoperative diet of liquids without milk but including broths, gruels, fruit juices, etc., until signs or symptoms of autointoxication appear.

12. Opium derivatives enough to relieve pain and quiet peristalsis.

13. No pitcher or cleansing douches of any kind, the *wound* to be left untouched at all times, preferably without any vulval pad. Plass proved twelve or thirteen years ago that untreated repairs heal best. All of us know how much better results are obtained in out-patient repairs without postoperative tinkering than in the overtreated hospital cases.

14. Dry heat from electric light bulb or ice-cap in a sterile towel locally is permissible for pain.

15. Watch daily for marked edema and pressure necrosis from suture. At any time after third or fourth postoperative day, clip the suture if it threatens to cut.

16. If patient is unable to empty the bladder, keep in a retention catheter and irrigate the bladder daily until the repair wound causes no discomfort.

17. No enema or rectal tube at any time.

18. Ten to fifteen days following operation, six ounces of mineral oil in divided doses, followed by a bottle of citrate of magnesia insures a soft stool without the necessity of traumatizing manipulation.

REFERENCES

(1) *Phaneuf, Louis E.:* Am. J. Obst. & Gynec. 17: 4, 475, 1928. (2) *Crossen:* Operative Gynecology, St. Louis, 1925, The C. V. Mosby Company. (3) *Plass, E. D.:* Bull. Johns Hopkins Hosp. 27: 107, 1926.

Roosevelt Building.

THE EARLY DIAGNOSIS OF ACUTE INTESTINAL OBSTRUCTION

By Fred M. Douglass, M.D., Toledo, Ohio

THE purpose of this paper is to call your attention to a method which enables the diagnosis of acute postoperative intestinal obstruction to be made very early. This has been brought about by the careful study of 67 cases. I have excluded from this discussion acute obstructions due to cancer or volvulus, strangulated hernia, and mesenteric thrombosis. The cases considered are those occurring postoperatively and can be divided into two groups: first, those occurring during the patient's stay in the hospital, and second, acute intestinal obstruction developed after the patient has left the hospital.

In the first group, there were 37 cases with 41 operations and 12 deaths, the mortality being 32 per cent. In this group there were 9 cases of purulent peritonitis, and of this number there was but one recovery.

The accompanying tabulation shows the type of operation preceding the obstruction:

After appendectomy, 18 cases, 6 deaths.
After pelvic inflammatory disease, 8 cases, 5 deaths.
After large twisted ovarian cyst, 4 cases, 1 death.
After resection of bowel, 1 case, 1 death.
After duodenal ulcer, 1 case, 0 death.
After hernia, 2 cases, 0 death.
After hysterectomy, 2 cases, 0 death.

In the second group there were 30 cases with 4 deaths, the mortality being 13 per cent. This offers a marked contrast with the above-mentioned group in which the mortality was 32 per cent. The argument might be advanced that this group contained cases more or less chronic in type, but careful investigation reveals that 18 of these patients entered the hospital within forty-eight hours after the beginning of the first symptoms and that the other 12 came into the hospital shortly after this forty-eight hour period.

In the reexamination of the records of the first group of cases, it is possible to obtain from the charts information which we believe would have made the outcome in this group much more favorable. I am of the opinion that the present signs and symptoms of acute intestinal obstruction as given in the literature and textbooks are found late in the disease.

In examination of a suspected case of postoperative intestinal obstruction, the surgeon must inquire first in regard to the type of pain

and discomfort from which the patient is suffering. The first symptom of intestinal obstruction is that of intensified abdominal pain, more or less localized. This is the type which is charted as "gas" pains but is distinctly different in that the pain is much more severe and colicky in nature. Intensification of gas pains occurred in 34 of the 37 cases and

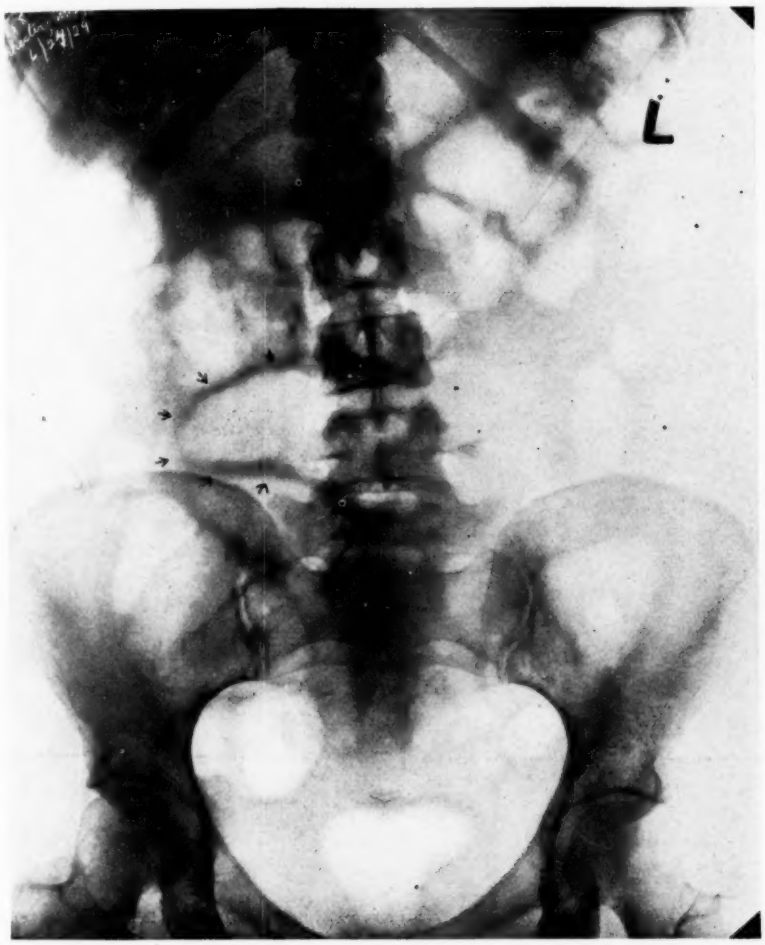

Fig. 1.—Partial obstruction of one loop, distended. The rest of the gas is in the large intestine. Distended loop is indicated by arrow.

was first noted from eight hours to five days before diagnosis of acute postoperative intestinal obstruction was made. Frequently the patient will state that she hears or feels rumbling of gas in the abdomen. Nausea is usually not present at this time, but may be. Vomiting at this stage in the disease seldom occurs. Hyperperistalsis is not seen until later. Upon inspection of the abdomen one notices but slight distention at this stage. Palpation, however, reveals a tenseness of the

abdomen. The distention, as ascertained by palpation, is much more constant than noted by inspection. Slight or moderate distention on palpation was found very early in 34 of the 37 cases. Auscultation in our hands has not been illuminating, but probably if done by Dr. King[1] would give further proof of obstruction at this stage.

Since the work of Case, we are able to confirm these clinical findings

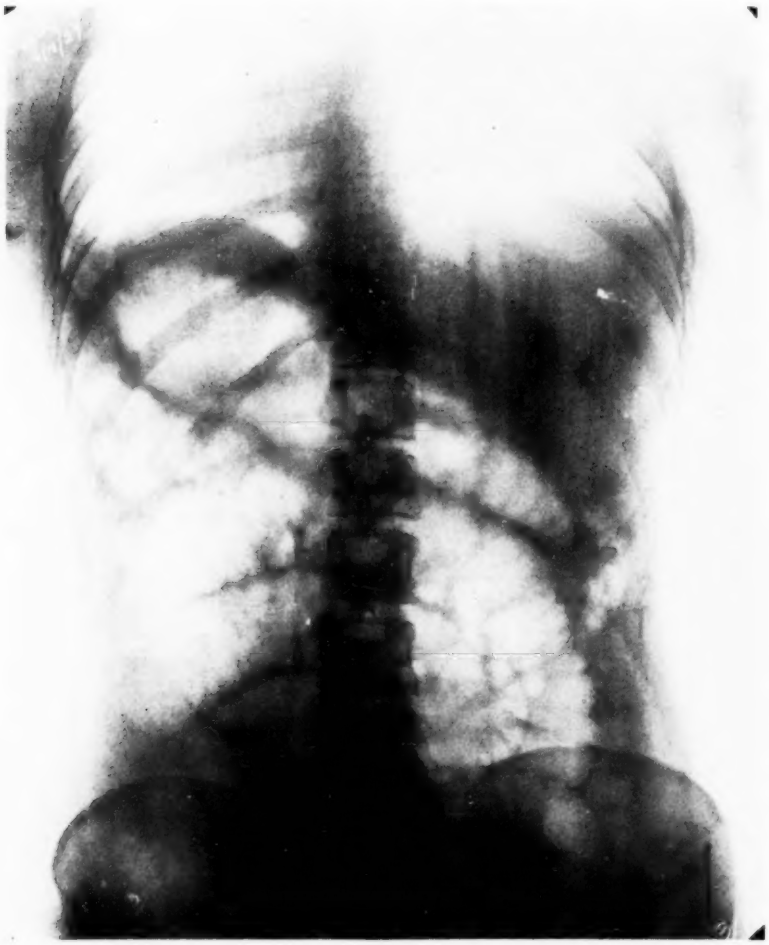

Fig. 2.—Ladderlike arrangement showing herringbone markings found in late cases

by means of x-ray examination of the abdomen. He called attention to the fact that roentgenograms of the abdomen will show distended loops of small bowel in early obstruction. Quoting from Dr. Case's[2] paper:

"Normally there is no gas in the small intestine, at least not in quantity sufficient to be recognized on the roentgenogram. In aerophagia and in certain stages of chronic small intestinal stasis not due to any organic obstruction, gas

found in the small bowel presents a characteristic appearance; numerous small, irregularly spaced gas areas, giving to the central portion of the abdominal shadow the reticulated or web-like aspect, which is in distinct contrast to the gastric and colonic gas collections. In acute small bowel obstruction the appearance of jejuno-ileal loops is very striking. Two types of bowel outline may be described: (1) a herringbone appearance due to the gas causing the folds of Kerkring to stand

Fig. 3.—Ladderlike distention of ileal loops, seventy-two hours after onset; obstruction of terminal ileum.

out by contrast, giving a feathery or slashed appearance to the intestinal loop; and (2) a ladder arrangement of the shadows of the bowel coils when the distended loops lie parallel. The latter appearance is pathognomonic of acute obstruction requiring immediate surgery.''

Dr. John T. Murphy, of Toledo, as early as 1924, was able to see, by means of the fluoroscope, distended small bowel in one case and confirmed our diagnosis of acute postoperative intestinal obstruction.

Since Dr. Case's work, we have observed the following cases and feel that the "herringbone" appearance comes late, as does also the "stepladder" arrangement, and the amount of distention of the bowel depends upon the amount of fluid and gas above the obstruction. We believe that a distended loop or two of small bowel in the presence of clinical signs completes the diagnosis.

Fig. 4.—Marked distention of many loops, indicating obstruction of long standing. This is associated with peritonitis.

We are of the opinion that when patients are extremely sick and plates are made at the bedside with portable machines, the anteroposterior position may fail to show definite distended loops on a ladder-like arrangement which could be demonstrated by means of lateral plates or may be noted by one trained in observation of the cross-section of the bowel as seen in the anteroposterior position.

The treatment of acute intestinal obstruction in our hands is about the same as that employed by most men. We attempt to overcome obstruction early by freeing the bowel when possible and draining the obstructed intestine by ileostomy. The usual supportive measures, as the maintenance of high water intake and blood chloride level by the

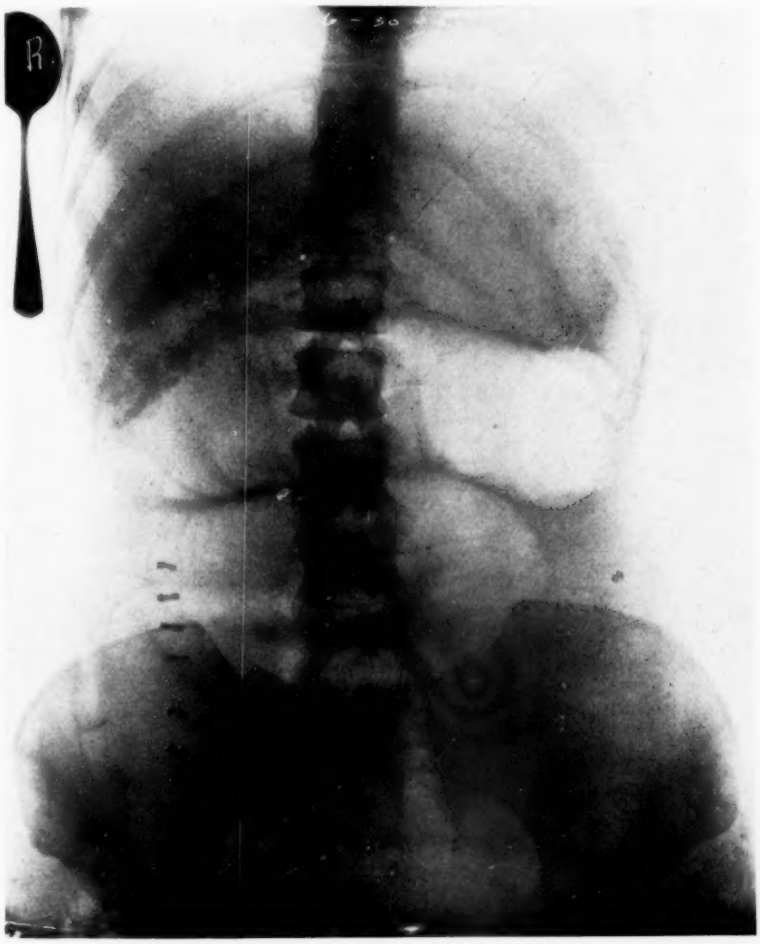

Fig. 5.—Massive distention of only a few loops. Herringbone effect seventy-two hours after onset of symptoms.

use of saline intravenously and by the hypodermoclysis, are followed. Blood transfusion has been of value in many cases. Glucose is given along with the saline to combat acidosis. The duodenal tube is used early and frequently. Heat in large amount is applied to the abdomen and over the liver area. Perfringen's antitoxin has been used, but we are unable at the present time to state its value.

COMMENT

In acute intestinal obstruction there is a definite period when pain is present along with some distention of the abdomen. Such symptoms as vomiting and visible peristalsis of the abdomen are rarely seen

Fig. 6.—Onset of first pain at 4 A.M. X-ray at 9 A.M., or five hours later, showing the three distended loops.

this early. The chart of the patient will reveal that enemas are productive and the patient is passing gas; and at this time examination of the blood chlorides and nonprotein nitrogen is of little value, because the obstruction is so early. X-ray examination is very helpful as a

confirmatory measure; and, because of this, it should be done early in all cases of suspected intestinal obstruction.

CONCLUSION

The study of the case records has convinced us that the diagnosis of acute intestinal obstruction can be made much earlier than has been done in the past. The use of x-ray has confirmed our clinical suspicion and has made us operate upon patients with acute intestinal obstruction much earlier than we previously did. With this in mind, we feel sure that in the future our present mortality rate will be greatly reduced.

REFERENCES

(1) *King, James E.:* Trans. of American Association of Gynecologists, Obstetricians and Abdominal Surgeons, p. 100, 1928. (2) *Case, James T.:* Am. J. Roentgenol. **19:** 413-425 (May), 1928.

421 MICHIGAN STREET.

THE PROTECTIVE RÔLE OF THE LIVER IN ABDOMINAL SURGERY

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THE liver, approximately the same size and weight as the brain, is placed as a buffer between the portal and systemic circulations. and is interposed between the spleen and the heart. The liver receives the blood from practically the entire viscera of the abdomen, yet the amount of arterial blood supplied to it is very little, as the final divisions of the hepatic artery are small in proportion to the bulk of the gland. It is interesting to visualize the adequate arterial blood supply of the thyroid and the kidney, where the biochemical activity is an oxidation process as compared to that of the liver. The vital functions of the liver are practically carried on with only venous blood. The major portion of the blood that traverses the liver is venous, one-sixth to one-eighth of which represents splenic blood. This venous blood contains the by-products of splenic metabolism and the intermediate by-products of digestion.

According to Crile the liver has a marked thermogenic function, as one-third of the heat production of the body is due to liver activity. "When the temperature of the liver is reduced one degree, its chemical activity is reduced 10 per cent." Furthermore, a fall in the temperature of the liver is always preceded by a fall in brain temperature, and resistance to traumatic stimuli is manifest in the brain either before or simultaneously with its effect upon the liver. Renauld Capart states

that abdominal blood is essential for cerebral activity and the blood which has passed through the liver possesses in greatest degree the property of reestablishing cerebral function. There are two specialized types of cells in the liver; hepatic cells which are concerned with bile elaboration and stellate cells which have a specific function in the reticuloendothelial system. The latter cells are capable of removing bacteria from the circulating blood by phagocytosis.

In any laparotomy, with or without exposure of the liver, there are a great many possible physical, chemical, infectious, mechanical and toxemic traumata, plus possible leakage from drainage, plus varying degrees of dehydration. The sum total of any or all of these surgical accompaniments may not necessarily be lethal to the ordinary, fairly normal surgical subject, but may often prove fatal to the handicapped patient or the patient with a depressed or an impaired liver competency.

The frequent association of hepatitis and abdominal disease has been amply demonstrated from both the clinical and pathologic aspects. Lesions of the liver may be unilateral and affect one half of the organ more than the other half. Cantile demonstrated that the liver is a bilateral and symmetrical organ with its morphologic center represented by the gall bladder fossa and with two sides of relatively equal weight. It is interesting to note that tropical abscess is almost invariably associated with the right side of the liver; the splenomegalias and gastric affections with the left side of the liver, while diabetes, when it is associated with liver pathology, almost invariably exhibits the hepatic change in the right lobe. Reidel drew attention to the fact that the lobe of the liver, which goes by his name, is confined to the right side, and Glenard states that Reidel's lobe was the direct result of inflammatory changes incident to gall bladder disease. Hess and Sergé attempted to segregate certain functions of the liver as being peculiar to either the right or left lobe. Glenard intimated that there was a difference in function between the right and left lobes and that the injection of staining fluid into various branches of the portal system was followed by unequal distribution throughout the liver, injections from the superior mesenteric vein showing a predilection for the right-sided distribution and that from the splenic vein predilection for the left side of the liver. Koffer demonstrated that the blood from the spleen, stomach, and major portion of the colon goes to the left lobe of the liver while the blood from the duodenum, head of pancreas, and jejunum goes to the right lobe of the liver. In other words, the by-products of alimentary absorption go to the right side of the liver, the products from colon and spleen go to the left side of the liver.

In carbohydrate metabolism the liver regulates quantitatively the amount of carbohydrate that is furnished to the body cells under the varying conditions of carbohydrate intake and bodily activity. According to Mann the normal blood-sugar level is maintained by the liver which adds glucose to the blood that passes through it. Furthermore, the liver concerns itself with protein metabolism in three ways: (1) deaminization, (2) urea formation, and (3) uric acid destruction. If the liver is removed, deaminization does not take place and urea is not produced, nor is uric acid destroyed. Obviously, if the liver, as

the result of abdominal trauma, loss of heat, portal infection or toxemia, or anesthesia, is impaired permanently or temporarily, in major or minor degree, then the glucose and protein function of the liver would be insufficiently maintained and we should reasonably expect postoperative complications of diverse types and varying degrees of gravity. In general, the deaths that occur after abdominal surgery are readily explicable on the basis of the pathologic condition found at operation, the type and the extent of the surgery performed, the preoperative condition of the patient, and the postoperative complications that ensue.

We are not concerned in this paper with postoperative mortalities that arise from cardiac failure, edema of the lungs, pneumonia, embolism, or sepsis. Death within the first twenty-four hours after an operation is not ordinarily due to sepsis but is the result of what we may call the mechanical factors of death: severe postoperative hemorrhage, acute gastric dilatation, shock, or leakage from intestinal anastomoses, etc. These lethal terminations are, as a rule, readily diagnosticated and within a limited degree are preventable or respond to adequate therapy. The full development of a fatal sepsis ordinarily requires a variable interval of time between the implantation of the infection and its full development. The occasion even of an acute fulminating, diffuse peritonitis usually exhibits what may be spoken of as a "clear interval"; that is, a certain definite time between the completion of the surgery and the development of the fatal termination. This interval, of course, may vary with the type and virulence of the organism, with the resistance of the patient, and with the degree of surgical trauma. The interval is manifestly longer in gynecologic surgery; while it has a shorter and more rapid incidence in perforations of the intestinal viscera, in colon, gall bladder, or stomach surgery. Furthermore, the development of a secondary abscess at the peritoneal site of an operation requires a certain amount of time before its death-producing possibilities become apparent or alarming. When all of these possible factors in the production of postoperative mortality in abdominal surgery are eliminated, there still remains a significant group of deaths that are not due to anatomic causes, that are not due to infection, and that are not due to overwhelming intoxication of high intestinal obstruction or perforation. The clinical manifestations of these cases suggest that the mechanism of death is a chemical one and is in a large measure due to liver failure or to an insufficiency of the protective function usually exercised by the liver.

Opie has intimated that under the ordinary wear and tear conditions of life the colon group of bacteria exhibits slight pathogenicity for normal animals. If, however, the liver is injured by some metabolic disturbance or some form of toxemia, the liver then becomes un-

usually susceptible to colon bacillus infection. The combination of chronic toxemia with a recently acquired bacterial invasion not infrequently precipitates an acute necrosis of the liver. Under ordinary living conditions many patients have sufficient liver function to maintain a certain degree of bodily welfare and activity. When this is interrupted by a surgical operation, or there is thrown upon an already compromised liver the increased burden of detoxifying a further increment of deleterious products, the liver is unable to do so; and the interim between operation and death represents the period of increasing and progressive exhaustion of liver capacity. The liver is notoriously able to control infectious and catabolic proteins that are the result of infection. If the dosage of these offending bodies is so great as to overwhelm the liver, or their toxicity is beyond the detoxifying power of the liver, it is a question only of time before the liver fails to give that protection which, under ordinary circumstances and even in the presence of a chronic abdominal condition, it has been competent to render up to this time. A little reflection will show that the individuals who die as a result of surgical intervention for malignancy present, as a rule, a different prelethal appearance than do the patients who are operated upon for long continued sepsis. Long continued sepsis, either within or without the abdomen, is characterized by a progressive physical deterioration. For an indefinite period the natural protective and chemical processes of the body hold the infectious process and the products of infection in check and may often bring about an abatement of the systemic injury; but with added years there comes a failure of the protective mechanism, and the injury of chronic sepsis is thrown upon the cardiovascular system, the muscles and tendon insertions, the peripheral nerves, and finally upon kidney and liver. In all these years of slight, trivial but accumulative septic injury, the liver is one of the chief organs of defense.

Jaundice after pelvic operations and in the presence of ectopic gestation is neither rare nor unusual and septic pyelophlebitis occurs after pelvic surgery as it does in the wider field of general abdominal surgery. The absorption of any great amount of wound serum means an increased burden on the part of the liver. Wound serum is essentially protein material which must be metabolized by the liver after absorption. In all laparotomies there are varying degrees of peritoneal denudation and particularly after certain pelvic operations. In all these cases there is peritoneal transudation and some wound secretion Drainage is indicated in these cases, not alone to prevent the development of sepsis but also to allow for external drainage of the accumulated wound secretions which might otherwise embarrass an already overburdened liver. Experimentally, it has been demonstrated that the injection into the circulation of the secretion from any large intra-

peritoneal wound is injurious to the hepatic parenchyma and the effect of such injections can be chemically estimated by a decreased output of bile acids and bile salts.

There are certain types of chemical deaths that are fairly well understood, the coma of diabetes, uremia and cholemia. But, how can one account for the deaths that occur in this manner? A patient, thirty-seven years of age, in apparently good physical condition, has 4,200,000 red cells, 78 per cent hemoglobin, 12,000 leucocytes, 78 per cent polynuclears, negative Wassermann, and normal phthalein test for kidney function. There is a blood pressure of 130 over 80, and a normal intestinal function. For a period of three years the patient has been complaining of pain in the upper abdomen, coming on at irregular intervals, usually after meals, relieved by bicarbonate of soda, and by vomiting. She has had one attack of pain requiring a hypodermic of morphine. The physical examination suggests gall bladder pathology, and a gastrointestinal x-ray series with a dye test confirms it. This patient is operated upon at nine o'clock in the morning. A simple cholecystectomy is performed; the common duct is not involved and the appendix is not noteworthy. The remainder of the abdomen is without any obvious pathology. The liver, however, shows macroscopically a slight enlargement. The edges are crenated. The consistency is leathery. In the area of the gall bladder is a white fibrous rosette-like tissue, radiating from the gall bladder area. The extent of this fibrous tissue diminishes with the distance from the gall bladder zone. Over the superior surface of the right lobe of the liver, but not over the left lobe, is a continuation of this fibrous tissue trabeculation. The operation is terminated in about three-quarters of an hour. The anesthesia has been given with care and caution. Following the operation the patient does not completely come out of her anesthetic but late that afternoon seems to be more dull than is usually the case. At the end of twenty-four hours the patient is distinctly lethargic, verging on complete somnolence. At the end of thirty-six hours coma has intervened and within forty-eight hours the patient dies without ever having actually emerged from a semicomatose condition. During the first twelve hours the urine has been of ample amount and from then on begins to fail progressively. The temperature rises from the moment of the termination of the operation and at the time of death is 104°-105°, or possibly 106°. The pulse rate parallels the temperature rise; and, if the pulse were 90 at the termination of the operation, it slowly goes up to 130 or 140. Clinical examination of the lungs shows no pneumonia. Chemical examination of the blood shows a normal icteric index and an ascending scale of urea nitrogen. The death certificate is signed "uremia." In our opinion this case is not uremia nor can it remotely be connected therewith. Some five years ago when we began to study our postoperative mortalities, we at first considered

these deaths as possibly due to an acidosis. Upon taking carbon dioxide combining power determinations we were surprised to find that an acidosis was not present; but, on the contrary, there was a distinct change in the alkali balance of the blood and we were dealing with a chemical condition that was essentially an alkalosis. We believe that this is not an infrequent postoperative complication in surgical conditions in the abdomen. Alkalosis may vary in degree from slight to severe to lethal. In the presence of persistent vomiting after laparotomy recourse should be had to blood chemistry determinations. If this indicates an increase in urea nitrogen, a decrease in chloride, and plus carbon dioxide combining power, alkalosis is the probable diagnosis and remedial measures should be adopted before the urine begins to show marked evidence of renal damage.

In alkalosis the administration of glucose is always advisable for two reasons: (a) because glucose helps to maintain the nutrition of the body—of all food material glucose is the most readily oxidized in the organism; (b) glucose is excellent for relieving dehydration. It is well to recall here that the administration of glucose is always useful in acidosis where its effectiveness is due to its property as an antiketogenic agent. However, inasmuch as these cases of alkalosis also have a severe degree of ketogenesis, the administration of glucose is of further value in this condition by reason of its specific antiketogenic effect.

We believe that glucose should be given either by rectum or by hypodermoclysis, because when it is absorbed from the tissues into the blood stream, it is transformed into that type of glucose normally found in the blood—the glucose which can be most readily oxidized. An excess of glucose administration should be controlled adequately by hypodermic injections of sufficient quantities of insulin.

The administration of sodium bicarbonate before operation is always dangerous unless it is carefully controlled by the CO_2 combining power of the blood. Determining the reaction of the urine to litmus paper is of no value and as a matter of fact may be misleading in gauging the amount of sodium bicarbonate to be utilized, because it has been shown that the CO_2 combining power of the blood and P_H of the blood plasma may be increased much above the normal before the urine becomes alkaline in reaction. The administration of sodium bicarbonate should be based upon the level of the CO_2 combining power of the plasma, utilizing Palmer and van Slyke's formula; that is, 0.5 gram of sodium bicarbonate will elevate the CO_2 combining power of the blood plasma one volume per cent for each forty-two pounds of body weight. Giving sodium bicarbonate beyond this limit elevates the bicarbonate of the blood plasma above the upper normal level and produces the uncompensated alkalosis which may lead to death in tetany.

The treatment to prevent what I have called "Chemical Deaths" following surgical intervention for abdominal disease is based upon the following considerations: 1. A continuous and persistent effort to combat the dehydration, whether it is sequential to vomiting or not. This is best accomplished by using known quantities of fluid, through all channels—water with 10 per cent glucose by rectum in the form of Murphy drip, normal saline with 5 per cent glucose by hypodermoclysis and normal saline with 5 or 10 per cent glucose solution intravenously. If the carbon dioxide combining power tends to the left, indicating a condition of acidosis, the glucose is particularly beneficial, because in the oxidation of glucose there is a destruction of the ketogenic bodies. If the carbon dioxide combining power moves to the right, indicating an alkalosis, the administration of glucose is primarily to prevent dehydration and in an important, but secondary rôle, the prevention of protein destruction. Associated with this is the giving of acid phosphate solution, 4 c.c. every two to three hours, as this has a distinct effect in lessening the alkali balance. If vomiting is persistent, this may be given by rectum.

2. Gastric rest is obtained by the introduction of a Levine tube, preferably passed through the nose and maintained in situ by affixing the tube to the patient's cheek with adhesive tape. This is particularly important if there is duodenal reflux, as it means a complete decompression of the stomach and maintains the stomach in a condition of rest and tranquillity by continuous evacuation of its contents. The Levine tube is passed over the side of the bed, placed in a bottle, and on the principle of siphonage keeps the stomach continuously empty.

A very simple test determines the evacuating capacity of the stomach. At a certain hour eight ounces of water are given by mouth, the patient drinking it freely; the Levine tube is clamped off and after an hour the contents of the stomach aspirated. If more fluid is obtained by aspiration than is given, it is obvious that the stomach is not emptying but is adding to its contents by regurgitation. If the quantity obtained by aspiration is less than that given, then the stomach is evacuating some portion of the fluid given. During the time the Levine tube is in place the patient may drink water and so allay the sensory and subjective sensations of thirst without endangering gastric tranquillity, as the fluid ingested is immediately drained back into the bottle by means of the Levine tube. The Levine tube is kept in the stomach until definite improvement occurs when the tube may be utilized for the purpose of fluid replacement by connecting a Murphy drip apparatus to the Levine tube, giving as high as 5 per cent glucose solution by the drip method.

3. In cases in which there is evidence of intestinal obstruction or marked jejunal reflux, jejunostomy has been a satisfactory procedure

in our hands. It completely takes care of the retrograde peristalsis and prevents the overwhelming toxemia of high intestinal obstruction and later is a ready means of fluid replacement by attaching the jejunostomy tube to a Murphy drip.

4. It is essential to have repeated blood chemistry determinations to control or indicate further therapy.

5. If symptoms of tetany appear, 5 c.c. of a 10 per cent solution of chloride of calcium are given intravenously and repeated when necessary.

6. Finally, avoid solutions of soda bicarbonate in any form; as soda bicarbonate is frequently employed for gastric lavage, it is particularly important to bear this point in mind.

115 East Fifty-Third Street.

TRANSITION TO MALIGNANCY IN BENIGN LESIONS OF THE UTERINE MUCOSA

By Willard R. Cooke, M.D., Galveston, Texas

THERE is probably no field in medicine that is generally more neglected or more poorly managed than the recognition and treatment of cervical and uterine lesions, benign and malignant. This is especially true in regard to the lesions which may be regarded as the forerunners of cancer of the cervix and endometrium. The importance of these "precancerous" lesions as a factor in the reduction of morbidity and mortality from malignant neoplasm can scarcely be overestimated. General recognition of the following facts would lead to adequate treatment of such lesions while still in the definitely curable stage:

1. Transition to malignancy occurs with varying frequency in a number of benign lesions.

2. Gross differentiation of these lesions from actual early malignant neoplasm cannot often be made.

3. Histologic study of biopsy specimens will, even in our present state of knowledge, afford a sounder basis for the treatment of such lesions: both through affording recognition of malignant and premalignant conditions and through the ruling out of malignancy in benign lesions suspiciously malignant in gross appearance.

4. On the other hand, there is a possible factor of error in diagnosis through biopsy alone which, though small, is sufficient to warrant the treatment of a lesion as malignant on adequate clinical evidence in the face of a negative biopsy report.

5. The removal of biopsy material is easy, involves no risk, there are no ill results, and the cost to the patient is justifiable.

Cervicitis and laceration of the cervix per se are adequately covered in the textbooks and in the current literature; but recognition of the

potential for malignancy in these, and especially in other lesions, is given little emphasis. In other fields of practice potential malignancy is fully recognized and given due stress: for instance in vesical papilloma and in chronic gastric ulcer. Yet in these fields such recognition is of less importance than in the lesions of the cervix and endometrium on account of the relative infrequency of the former, the relatively advanced stage which is often reached before suspicious symptoms appear, the relative difficulty in obtaining biopsy material, and the relatively incurable status of the lesion when treatment is instituted. Moreover, in the practice of gynecology, laboratory methods as an aid to diagnosis are far too often disregarded or neglected. In this respect gynecology has lagged far behind internal medicine and other branches of practice. The objection is often made that biopsy-diagnosis involves an unjustifiable amount of discomfort and expense to the patient, in view of the relative infrequency of significant findings. Surely, the removal of a bit of tissue from the cervix or of scrapings from the endometrium does not entail either as much discomfort or as much expense as the serologic and chemical study of the blood and spinal fluid; yet these procedures are almost routine with the internists, even where there are no clinical features suggestive of their necessity, and significant findings are of far less importance than the discovery of an early cancer or sarcoma. What is even worse, curettage under anesthesia (often without reason) is an everyday procedure, and in such operations the material obtained is thrown away and gross lesions of the cervix dismissed with a useless scraping or a touch of some chemical agent. Another common and very serious error is seen in the performance of some plastic operation on a cervix which is the seat of a lesion whose innocence cannot be established except through histologic study. There are two examples of this error in material received in our laboratory.

In the material obtained in the Gynecologic Service of the John Sealy Hospital (the teaching hospital of the University of Texas) actual transition to malignancy has been observed in the following lesions:

1. Laceration of the cervix with cervicitis, with and without eversion.
2. The lesion known variously as eversion, erosion, ectropion, which is listed by us as ectropion.
3. Chronic cervicitis.
4. Adenoma of the cervix.
5. Adenoma of the endometrium.

LACERATION OF THE CERVIX

We have seen no cancer originating in a cleanly healed laceration. Where laceration is present, the condition of the overlying and surrounding mucosa has seemed to be of more importance than the presence of scar tissue. While we are not at all ready to dismiss the cleanly healed laceration as an etiologic factor in cancer, we feel that complicat-

ing eversion, ectropion and cervicitis are much more important. In the few cases of cancer occurring in lacerated cervices where an adequate description of the conditions found at previous examinations was available, some lesion other than laceration was always noted.

EVERSION, EROSION, ECTROPION

There is so little unanimity in the nomenclature of this group of grossly somewhat similar lesions that it is difficult, in reading, to determine just what is meant by a given writer. On an etymologic basis we have adopted the following definitions:

Eversion.—A mechanical "turning-out" of the glandular epithelium of the cervical canal, through the gaping of the lips of a lacerated cervix plus the covering of the raw surfaces of the laceration by outgrowing cylindric epithelium; or, somewhat doubtfully in chronic cases, through the pouting of swollen tissues about the external os.

Erosion.—An excoriation of the surface epithelium to varying depths.

Ectropion.—A "growing-out" of cylindric epithelium, replacing the normal squamous epithelium of the area involved.

Whether this or another nomenclature be considered best, we believe that the general adoption of a standard set of definitions would be of real value.

EVERSION

The exposure of cylindric epithelium to an abnormal environment may result in (1) inflammation (practically always); and (2) a metaplasia to the squamous type of epithelium (which is apparently a protective process). It seems probable that either of these processes may be conducive to the development of malignancy. There will be no attempt in this paper to discuss the exact process by which this transition is initiated, since in our material we have seen nothing to indicate whether the change is due to metaplasia, to the occurrence of cells of specifically malignant potentiality, to "irritation," or to any other definite factor or process.

In studying the gross appearance of the visible epithelium of the genital tract we have found that tincture of iodine is a valuable gross differential stain. On application the whole area is stained a uniform medium brown; very promptly this color disappears from any raw surfaces, leaving them pink; in a few more moments the squamous-cell epithelium develops a very deep and lasting brown color (in the skin the shade is lighter); while the glandular epithelium is stained a pinkish brown which fades rather rapidly to the normal color. (This differential stain has also proved of great value in plastic work about the cervix and perineum, especially in the immediate repair of obstetric lacerations.) With the aid of this stain I have followed a number of minor lacerations of the cervix through the process of healing after labor.

At first only the raw surface of the laceration is evident. After about forty-eight hours on the average a definite encroachment of rather poorly-staining epithelium is seen creeping in from the outer edges of the raw surfaces; the rate of this ingrowth varies greatly, the raw surfaces having been completely covered in two cases within five days, while in the average case, healing is practically complete in ten days. In almost all cases there is also a relatively slow outgrowth of cylindric epithelium, forming a zone of varying width along the inner edges of the raw surfaces. In a few cases the cylindric-cell outgrowth has overshadowed the squamous-cell ingrowth, the greater portion of the raw surface being covered by a slowly-formed sheet of cylindric-cell epithelium. In these cases, and in the cases which healed slowly by the normal process, granulation tissue became apparent. We consider the process of covering with squamous-cell epithelium as the normal protective process, and the result as the cleanly-healed laceration. As indicated above, we have no evidence in our material that this condition is conducive to the development of cancer; yet we do not consider that the innocence of this condition can be even presumed, as yet. To the process of covering of the raw surfaces with cylindric-cell epithelium, we have given the name of "eversion"; sooner or later we have found that such a cervix becomes the seat of chronic inflammation; and we have seen several instances of the appearance of early cancer in cases of eversion.

From the practical point of view, we feel that this study lends weight to the theorem that lacerations of the cervix should receive adequate care promptly after labor: in extensive tears, immediate or delayed repair (dependent upon the environment) should be done; in minor lacerations, the cervix should be treated by cauterization of any surfaces which are granulating or covered with cylindric-cell epithelium, this to be done on the tenth day or at the end of the fourth week. All cases should be reexamined at intervals, and all persistent areas of granulation tissue or cylindric-cell epithelium recauterized until all of the exposed surfaces are solidly covered with squamous-cell epithelium. In this work, the iodine stain has proved invaluable.

EROSION

As defined above, we have seen this condition in only two nonpuerperal cases, as compared with several hundred cases of ectropion and eversion. It is, however, quite common as an apparently transient process following labor. We have seen a narrow zone of denuded cervical tissue at the edge of several specimens of ectropion; but in these instances the possibility of artefact was so great that we had no assurance that such apparent erosions were a part of the process of ectropion. The great majority of the ectropia showed no evidence of a zone of erosion, either microscopically or by the gross iodine stain

We have had two cases, diagnosed clinically as erosion, which proved to be very early inverting epitheliomas.

Our rule of clinical procedure is that all nonpuerperal erosions be subjected to biopsy. In the case of the tiny multiple excoriations so commonly seen in connection with an irritating cervical discharge or consequent upon the injudicious use of chemical douches, biopsy is not done as a primary procedure, as it has been found that such lesions heal promptly on the elimination of the etiologic factor; if they persist, however, after a reasonable period of treatment, biopsy is indicated.

ECTROPION

This is an exceedingly common process, in itself deserving early recognition and thorough treatment because of the symptoms to which it gives rise. (Parenthetically, sterility is notable among these symptoms: with the possible exception of retroversion, there has been no single condition in my experience in which sterility has been so definitely and promptly relieved by adequate treatment.)

From the standpoint of etiology we recognize two varieties of ectropion:

1. Developmental ectropion, apparently due to abnormal differentiation of the epithelium of the portio vaginalis of the cervix about the external os; possibly as a congenital process, and possibly occurring in connection with the rapid changes incident to adolescence. This variety is very common in adolescent virgins, and gives rise to much unnecessary discomfort, dysmenorrhea, and disability through neurosis. Usually, by the time a microscopic specimen can be obtained, complicating inflammatory processes have set in.

We have no evidence that this condition is of any consequence as a precancerous lesion in the virginal adolescent patient; hence we consider that biopsy is not indicated unless the lesion fails to heal after proper treatment.

2. Acquired ectropion, in which the stimulus to abnormal growth is unknown. From our material we are inclined to believe that antecedent erosion is not essential; that the process is one of replacement and not of metaplasia; and that while chronic cervicitis is present in most cases, we are not sure that it is not merely a coincidental condition, since identical ectropia have been seen without evidence of inflammation.

Structurally, there are three types of ectropion: the simple type, in which the glandular mucosa is grossly smooth and histologically resembles the ordinary mucosa of the cervical canal, with or without various inflammatory changes; the follicular (granular or glandular) type, in which the surface is granular, with histologic evidence of hyperactivity in the pseudoglands; and the papillary type, this name being self-explanatory. The last type is the one we have seen most often in specimens from adolescent virgins, and may represent an

attempt at the formation of rugae like those of the arbor vitae of the cervical canal. We have seen nothing to indicate that there is any difference between these types as regards their clinical or pathologic course.

We recognize three stages in the normal life-history of ectropion: the progressive stage, during which the glandular epithelium spreads out gradually from the external os, replacing the normal squamous-cell epithelium; the quiescent stage, in which the process of growth remains inactive, usually over a period of years; and the regressive or healing stage, in which the growth-process is reversed, the squamous-cell epithelium growing inward to replace the ectopic glandular epithelium. The most interesting feature of the whole process is the plugging of the pseudoglands through down growth of squamous epithelium into their lumina in the process of healing: the lining of the gland-cavity, now packed with squamous cells, gradually perishes, leaving peninsulae or even islands of squamous cells deep in the stroma of the cervix. Normally, these plugs flatten outward to the general surface-level, and ultimately disappear.*

THE PRECANCEROUS CERVIX

Some years ago, Henry Hartman described an interruption of the normal healing process in ectropion, which he designated as the "precancerous cervix." Briefly, this condition presents the microscopic picture of active proliferation in the ingrowing squamous cells of ectropion, usually in the peninsulae described above, accompanied or followed by round-cell infiltration of the subjacent tissues. Similar changes also occur in eversion and in chronic cervicitis; in these, the cellular proliferation may occur in either the squamous or the cylindric epithelium. We are inclined to believe that this is a real pathologic entity, since we have observed several indubitable early cancers in which the picture very strongly suggested that the cancer had its origin among the rapidly growing and apparently nonmalignant cells typical of the "precancerous cervix." Unfortunately, from the academic viewpoint, all of our own cases of this type were adequately treated at the time the biopsy material was obtained so that we have no positive evidence from this standpoint that a continuance of the process would result in cancer. We have, however, several specimens of cancer in which a previous clinical diagnosis of precancerous cervix had been made, biopsy and treatment being refused by the patients; and six cases where a laboratory diagnosis of precancerous cervix had been made before the patients came into our hands with definite early cancer.

Two cases clinically diagnosed as precancerous were found to be actually malignant.

*For an excellent concise description of the whole process, see R. T. Frank, Gynecological and Obstetrical Pathology, in the Gynecological and Obstetrical Monographs, Appleton & Co., New York.

The clinical diagnosis of precancerous cervix is made on the history of the symptoms of chronic cervicitis, with or without blood-stained discharge, plus the finding on examination of a grossly proliferating eversion, ectropion, or chronic cervicitis which bleeds freely upon being lightly rubbed with a cotton-tipped probe.

Treatment of eversion, erosion, ectropion, and precancerous cervix: We believe that our findings fully justify biopsy as the essential corner stone in the safe treatment of these lesions, except in transitory erosions and in virginal adolescent ectropion. Unless the biopsy specimen be sufficiently large, chosen to include the most grossly suspicious-looking areas, and promptly placed in the fixing fluid, the pathologist's report is apt to be misleading. An important and common fault is the acceptance of a visible surface lesion as the essential feature of the case, neglecting investigation of the cervical canal and uterine cavity. As mentioned before, if from the clinical evidence there is doubt of the reliability of the pathologist's report of "no evidence of malignancy," the case should be treated as for malignant disease.

At the time of removal of the biopsy specimen in cases of simple cervicitis, erosion, and ectropion, all exposed cylindric-cell epithelium is destroyed by cauterization, down to the fibromuscular substance of the cervix, including also a narrow strip of the circumjacent squamous-cell epithelium. Anesthesia is unnecessary except in very extensive lesions, so that this treatment is almost always an office procedure. The subsequent management consists in the prescription of douches of 4 per cent saline solution twice daily, with inspections at weekly intervals until healing is complete. In cases of extensive eversion where denuded areas may become apposed through the shrinking of the cervix, measures to prevent partial or complete occlusion should be taken at each inspection. At the end of four weeks the treated area is restained with tincture of iodine: this brings out sharply any islands of ectopic cylindric-cell epithelium and any areas of granulation tissue, which are then retreated with a small cautery. Such cases require the same treatment and observation as for the primary procedure. This treatment has been employed for ectropion and eversion in 211 hospital cases and in 226 office cases, with so far extremely satisfactory results. Our follow-up records show definitely a greater freedom from complications and a better final condition than were secured after any form of trachelorraphy.

From our material, the same treatment is adequate also for precancerous cervix; but in these cases the cauterization should be much more thorough, going more deeply into the tissues, and including a zone of 3 to 5 mm. of healthy tissues around the periphery of the lesion; and these cases should be kept under monthly observation for at least a year after apparently complete healing, and warned to report promptly on the appearance of any suspicious symptom, especially of a watery, irritating, brown, or blood-stained discharge.

Treatment of precancerous changes within the cervical canal: In these cases the cautery cannot be freely used on account of the danger of serious cicatricial stenosis, and the problem is difficult. Our material is far too scant to justify the recommendation of our plan of procedure in cases of precancerous change within the canal diagnosed by biopsy, which is as follows: 1, patient under thirty-five years of age potentially fertile: Sturmdorf tracheloplasty; 2, patients incurably sterile or thirty-five to forty years old; high transverse amputation of cervix; patient over forty; radium, unless contraindicated. Exceptions to these rules based on common sense as applied to the individual case, are frequently made.

CHRONIC CERVICITIS

There is no need for discussion of this condition, as its malignant potentiality is recognized, and because our material has afforded us no new or interesting findings.

ADENOMA OF THE CERVICAL MUCOSA AND ENDOMETRIUM

Opinion in regard to the real character of the adenomatoid lesions of these structures is so diverse that we have undertaken a study based upon the grouping of the specimens according to:

1. The menstrual phase at the time of removal of the specimen.
2. The existence and degree of complicating circulatory, inflammatory, and neoplastic conditions.
3. The histologic evidence of intrinsic inflammation.
4. The gross and histologic structure.

Pending the accumulation of an adequate amount of material no report on this study will be made. We do believe, however, that a considerable number of the polypoid growths, both in the cervix and in the corpus uteri, are true adenomas. No conclusion has as yet been reached in regard to the diffuse polypoid overgrowth which has been variously designated as polypoid endometritis, fungoid endometritis, polypoid hyperplasia, etc. Simple diffuse hyperplasia of the endometrium is of course recognized as a definite histologic entity, although there is much yet to be learned in regard to its etiology, its relation to the polypoid type of hyperplasia, and its ultimate significance.

From the clinical viewpoint, abandonment of the term "polyp" seems a valuable step forward. Several utterly diverse lesions are so diagnosed without reference to their pathology, which is the only logical basis for treatment. Recent or organized blood clot; masses of organized exudate; placental moles; adenomatoid growths; the various polypoid endometrial trophic (?) lesions; pedunculated submucous fibromyomas; everting cancer; chorioma; and sarcoma are all referred to in the literature by various writers as "polypi."

Four specimens from our material deserve mention, as they represent definite malignant change in the so-called "mucous polypi." The older textbooks denied the possibility of such a development; in the more recent editions the possibility of malignant change is recognized, but the emphasis is so scant that the statements are apt to pass unnoticed unless specifically sought. It is true that malignant change is very rare in these lesions; yet the prevention of one death from cancer fully justifies the microscopic examination of a thousand innocent adenomas.

One of our specimens is from the cervix; three from the endometrium. It is especially significant that the first report on the biopsy specimens from three of these endometrial growths read: "no evidence of malignancy"; a finding which was easily explained by the fact that sections made from the periphery of these growths after removal were typical of nonmalignant adenoma, the carcinoma occurring only in and about the pedicles.

Sarcoma has not occurred in our material.

In treating clinically benign growths of this type, biopsy should always be done; and, as a safeguard, the area surrounding the bases of accessible adenomas should be thoroughly and deeply cauterized in every case. It is our rule, in dealing with relatively inaccessible lesions, to treat them as malignant if the clinical findings are sufficiently suggestive, regardless of the pathologist's report. This rule has been justified at least six times by the finding of malignant disease in the removed uterus, when nothing of the sort could be found in the biopsy specimen.

CONCLUSIONS

1. Transition to malignancy is sufficiently frequent in and about ectopic glandular epithelium and in accessible adenomatoid growths as to demand routine biopsy and radical destructive treatment with the cautery (especially since this is the most effective treatment of such lesions if benign). Exception: the necessity for biopsy is not imperative in cases of eversion or ectropion in patients under twenty-five years of age unless the lesion bleeds freely on slight trauma or unless it fails to heal promptly after adequate cauterization and after-treatment. In cases where there is the slightest doubt as to the gross diagnosis, biopsy should be done as a preliminary to the treatment of any coexistent lesions, especially before undertaking any plastic work about the cervix.

2. All adenomatoid lesions of the cervix and endometrium demand careful histologic study; if the clinical picture is sufficiently suggestive, the condition should be treated as if definitely malignant.

3. All easily-bleeding lesions and all single large or deep erosions should be subjected to biopsy, being careful to secure a piece of tissue which includes the entire lesion and its edges.

4. Promptness and thoroughness in investigating and treating all cases of cervical and endometrial disease (especially if metrorrhagia, however slight, be a feature) will result in a definite decrease in the incidence of cancer in these loci.

This study is based upon the following material from the records of the Gynecologic Service of the John Sealy Hospital and the Laboratory of Gynecic Pathology of the University of Texas (tabulated below); upon a considerable number of office cases; and upon 444 specimens in the Laboratory of General Pathology of the University of Texas (not tabulated on account of some duplication).

Eversion, Erosion, Ectropion			211
Precancerous Cervix:			
Clinical Diagnosis:		Precancerous, microscopic negative	54
"	"	Cancer, first stage, microscopic precancerous	8
"	"	Confirmed by microscopic examination	43
"	"	Adenoma, microscopic precancerous	1
Cancer of Cervix, all types:			
Clinical Diagnosis:		Unsuspected	2
"	"	Adenoma	1
"	"	Doubtful	3
"	"	Correct, first biopsy report precancerous	3
		" First stage	8
		" Second stage (Cervix only involved)	20
		" Third stage (Parametrium involved)	128
Carcinoma Endometrium			
Clinical Diagnosis:		Correct	9
"	"	First biopsy report negative	3
"	"	Incorrect	3

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THE SURGICAL TREATMENT OF CERTAIN PUERPERAL INFECTIONS

BY J. F. BALDWIN, M.D., COLUMBUS, OHIO

*"The woman about to become a mother, or with her new-born infant upon her bosom, should be the object of trembling care and sympathy wherever she bears her tender burden, or stretches her aching limbs. * * * The solemn prayer of the liturgy singles out her sorrows from the multiplied trials of life, to plead for her in the hour of peril. God forbid that any member of the profession to which she trusts her life, doubly precious at that eventful period, should hazard it negligently, unadvisedly, or selfishly!"—Oliver Wendell Holmes, "Contagiousness of Puerperal Fever,"* 1843.

JUST twenty years ago I had an experience which led me to make a most thorough study of puerperal sepsis, as the patient and the families on both sides were all personal friends. The patient was wealthy, so that there was no stone left unturned to secure her recovery. This was in the days before blood counts and blood cultures. She was twenty-eight years of age, the mother of two children, the youngest just three weeks old. She had a chill a day or two after the birth of this child. The birth was normal in every way, but the attending physician was a surgeon who was notoriously a disbeliever in microbes. He had

made but one vaginal examination, and that several hours before the birth of the child, which took place a very few minutes after he reached the house the second time. She had been having daily chills, with a daily range of 10° of temperature. Lochial discharges normal. Her physician had attributed her febrile condition to "nervousness." I saw her in consultation immediately after there had been a change of physicians. At that time there was a large mass in the pelvis on the left side of the uterus. She was brought to the hospital at once and placed in a large, quiet, sunny room, with three special nurses in charge, and with two of our best physicians in frequent attendance. The next day, under an anesthetic, examination seemed to indicate the presence of a small abscess in the left broad ligament. This was opened through the vagina and gave exit to about a dram of thick odorless pus; but the opening of the abscess had no effect on the progress of the disease. A few days later she was seen in consultation with Dr. Gustav Zinke, of Cincinnati, who found no indication for any surgical procedure; but who, although he said he had no faith in such treatment, advised anti-streptococcus serum, which was given her freely. He saw her in consultation again ten days later but could offer no further suggestions. She became delirious and died, with all the typical symptoms of puerperal sepsis, eight weeks and one day after the birth of her child. Autopsy was earnestly urged but refused.

With my present knowledge I am quite certain that a sufficiently radical operation made when she entered the hospital would have given her at least a 75 per cent chance for recovery; her condition at that time being strikingly similar to that of Case 2 of my series.

At the Buffalo meeting of this Association, in 1914, I read a brief paper on the operative treatment of puerperal thrombophlebitis. Four cases were referred to but only the fatal one was reported; a mortality of 25 per cent. At the meeting of the Association in Albany, in 1922, a much more elaborate paper was presented with detailed reports of 67 cases, with a mortality of a little less than 30 per cent. During the intervening years, up to 1929, seventeen cases were operated upon with a mortality of 17.6 per cent. So far during 1929 I have operated upon six patients with no deaths. One of these, and clearly the most hopeless of the number, I had the pleasure of presenting to this Association at our clinical meeting at Columbus last March, just a few days before she went home with her baby. We have, therefore, a total of 90 cases with 23 deaths; a death rate of 25.5 per cent; and the contention is that these 90 cases belong to a class which without operation give a death rate of 100 per cent; so that 67 mothers were saved.

If a hospital places all its puerperal infection cases in one class, and counts as infected those which on two successive days present a temperature of 100.5°, the death rate will be very small; but if the cases are classified as suggested in my Albany paper, the death rate in Class 5

will be 100 per cent; but this class will constitute but a small part of the total number of infected cases. In my Albany paper there appeared a fairly full history of the 67 cases, but necessarily these histories had to be condensed. I have repeatedly challenged the obstetricians to pick out a single one of those cases that in their opinion would have recovered without operation. Thus far no one has accepted the challenge. If any one should attempt it and pick out such cases, I would be only too glad to give him such complete notes and details as might cause him to change his opinion.

Dr. C. Jeff Miller, in his article on this subject in Dean Lewis' *Practice of Surgery,* Vol. 10, states that puerperal infection is "essentially a wound infection which is identical * * * with wound infections elsewhere in the body." Wound infections in general are universally looked upon as surgical and to be treated on surgical principles, though by no means necessarily by operation. It is a leading principle in surgery that where there is pus it must be evacuated, the only real questions being in each case when and how to secure evacuation. The late Samuel D. Gross, in his monumental work on Surgery, relates a case in which death resulted from a single abscess the size of an almond, no other pathology being found at autopsy.

Those of us who are old enough can remember, and the younger ones can readily get an idea of it by reading, the ridicule heaped upon Lawson Tait by his colleagues over his diagnosis of pus tubes, when the London surgeons would tell inquirers that pus tubes "were only found in Birmingham." We can remember also the denial by Tait himself of the possibility of making a diagnosis of tubal pregnancy before rupture; and the delay and opposition met with by the surgeons of a few years ago in regard to the diagnosis and operative treatment of appendicitis. Just recently I happened to pick up the volume of transactions of the Ohio State Medical Association of 1899, in which appears a symposium on appendicitis participated in, among others, by Ricketts, Reed, Johnstone and Reamy, of Cincinnati, Sherman and Crile, of Cleveland, and Kinsman, Hamilton and myself, of Columbus, the gist of which was that not less than 80 per cent of patients with appendicitis recover without operation, and that operation should be made only after very careful consideration.

It is becoming more and more evident that operative procedures in this class of cases of puerperal infection will ultimately be adopted. At the Cincinnati meeting of the Ohio State Medical Association last year Dr. Palmer Findley, at that time president of this Association, delivered an address on the subject of puerperal infection. His treatment was distinctly nonoperative, but at his conclusion he referred to my work as follows: "I am aware of the splendid work which Dr. J. F. Baldwin of your state has done in pyemic cases and of the favorable

results he has obtained, but such results can only be obtained in the hands of a master diagnostician and operator."

I was not present at that meeting and did not know of his complimentary remarks until his paper was published; then, to use the language of the witty Oliver Wendell Holmes when somewhat similar phrases were used about his paper on the contagiousness of puerperal fever, his compliments "made me blush either with modesty or vanity, I forget which."

I promptly wrote to him protesting against being placed in a class by myself and insisting that there were plenty of other surgeons who could do similar work. I reported to him at the same time two recent cases upon which I had successfully operated; but my protest signally failed to convince him for in his reply he said: "I recognize that there are a few men but a very few, who have the ability and experience to get away with such surgical intervention; but the rest of us will certainly meet with disaster. I am perfectly frank in saying to you that I feel that your results are remarkable and this can only bespeak such surgical judgment and technic as few men possess. This is a real compliment to you, my dear fellow, and in no way an endorsement of the procedure as it would be practiced in general."

A number of surgeons, several of them Fellows of our organization, have been equally complimentary in commenting on my results, but claim their inability to follow my lead. Doubtless my large and long experience, coupled perhaps with some native mechanical ability, does enable me to operate more rapidly and with less trauma than many others, and my very careful bimanual examinations have perhaps developed a certain *tactus eruditus* possessed by only a few, but I insist that there are many surgeons who possess such an ample degree of diagnostic ability and operative skill as to operate successfully on these cases *if they will only give each patient the proper amount of careful personal study.* The study of these cases should not be left to interns and assistants. The surgeon should feel in each case the responsibility indicated by Oliver Wendell Holmes, and govern himself accordingly.

These cases are admittedly not cases for the surgical tyro, but each patient is entitled to the best that surgical and diagnostic skill can offer. No man should operate who requires more than thirty minutes for anything like an ordinary hysterectomy, nor should anyone operate who is not thoroughly familiar with his anatomy and pathology. That occasionally an unnecessary operation may be made is beyond question, but the possibility of such an occasional error should not deter from efforts to save these mothers.

I will report the case of only one patient, the one shown at our clinical meeting last March. The other cases operated upon since my report of the 67 cases in 1922 are so similar to those cases that I can only refer those who are interested to the report of those cases as it appeared

in our volume of *Transactions* of that year. I report this one case because it was probably the least hopeful of any, though several others would certainly be a close second as was one of those which I reported during the discussion of Dr. Polak's paper last year at Toronto.

Jan. 31, 1929: Mrs. H. T., aged twenty-four. Married two years; one child, aged eighteen days. Patient passed through an entirely normal and happy pregnancy. The child was born in a few minutes after entering the hospital, and the afterbirth followed a few minutes later. No examinations of any kind had been made. The next day, however, she had a chill followed by the usual symptoms of profound sepsis, though with no additional chills. Her physician applied mercurochrome to the walls of the vagina and packed some gauze dipped in mercurochrome into the uterus, but this was without any effect. A little later some tissue was removed which was looked upon as possibly placental, but the microscopist reported that it was a piece of endometrium. When I saw the patient in consultation on the eighteenth day, the hospital notes showed a rapidly progressing anemia, with a high leucocytosis and a daily elevation of temperature to 104-5°; she was profoundly septic. The pelvis was filled with a solid mass of exudate, and pressure along the inside of the right ilium showed a point of extreme tenderness which I assumed was an abscess of the right ovary. Prompt intervention was advised, and carried out the next morning.

Examination under the anesthetic showed nothing new. On opening the abdomen, the uterus was found much larger than it should have been, and the fundus free from adhesions. Below the fundus, however, the uterus was simply bedded in masses of exudate on all sides; both broad ligaments extensively involved. Both tubes edematous. The omentum adherent to the right ovary, which was found abscessed. Separation of adhesions showed multiple abscesses throughout the pelvis. A panhysterectomy was made, but the left ovary and tube were saved because of the youth of the patient. The tissues were exceedingly friable so that it was impossible to implant the round ligaments into the vault of the vagina. The usual gauze fluff was inserted and the sigmoid attached completely around the brim of the pelvis.

Hasty examination of the specimen showed an abscess of the right ovary and an abscess in the posterior wall of the uterus. All the tissue was referred to the laboratory which soon reported "small pockets of pus within the uterine wall." "Multiple abscesses in ovary containing greenish-yellow exudate." The laboratory finally reported: "(1) Acute suppurative metritis. (2) Acute suppurative endometritis. (3) Acute suppurative salpingitis. (4) Acute suppurative oophoritis." Culture of the pus showed "many short-chain streptococci, Staphylococcus aureus and albus."

Patient had a rather stormy convalescence but went home happy with her baby March 17.

On the continent, two eminent surgeons, Gosset and Autefage, have come out strongly in advocacy of treating these cases on general surgical principles and by radical operative procedures. I am indebted to Dr. Albert De Groat, of Fayetteville, Ark., for a report of two cases of puerperal infection operated upon by Autefage, in both of which hysterectomy was followed by recovery. Autefage contends that hysterectomy is indicated in puerperal infection when, after an abortion, the temperature remains high and chills persist in spite of complete evacuation of the uterus, and when a subacute infection occurs after labor with marked systemic symptoms and appreciable lesions of the uterus and adnexa.

In a letter just received recently from one of our Fellows, heretofore very pronounced in his opposition to any radical operation, he tells me he has become half a convert at least, and has recently operated upon two of these patients with recovery.

As an evidence of the on-coming of operative procedures in these cases, it may be mentioned that at the meeting of the Section of Obstetrics and Gynecology of the Massachusetts Medical Society last June, a paper was read by Dr. Kickham, Senior Visiting Obstetrician to St. Elizabeth's Hospital, on the treatment of puerperal sepsis. In the course of his paper the doctor says that he "feels that in a certain number of cases, surgery with removal of the uterus will save a percentage of patients. He bases this opinion on cases which have come under his direction where they did not have a fulminating infection that kills in a few days and in which no treatment seems to be of value, but where they went along for ten days or more with gradual weakening and ultimate death, despite general stimulative measures. His deductions were, that in this type of cases, the removal of the large focus of infection would prevent further injection into the general circulation of toxin or bacteria and allow the forces of nature, that were already battling the disease, to overcome the amount of toxin or bacteria that was already in the system." (*New England Journal of Medicine*, Sept. 5, 1929.)

In the volume of *Transactions* of this Association of last year appears a synopsis of 23 fatal cases of puerperal infection occurring in one large hospital. A study of these cases shows, so far as their records appear, that much was done in the way of laboratory study of the cases, but little or nothing in the way of anything like a thorough physical examination in any of them. Taking the records of these cases as they stand, it may be said that Cases 1, 5, 6, 7, 10, 12, 14, 15, 17, and 23 should have been given the chance of an operative procedure. There are one or two of the others that might have been operated upon successfully if operated upon early enough, but perhaps some of these others would have been found hopeless under a thorough local examination. It is probable that

this report could be practically duplicated by any large hospital admitting maternity cases and in which, *because of the rule of nonintervention,* no careful study is made of puerperal cases but all are placed in a common class.

During the last few months three puerperal deaths have occurred in one Columbus hospital. From what I could learn, all three were cases that apparently should have been operated upon. I happened to be present at the single autopsy that was made, and that showed the whole trouble to be clearly limited to multiple abscesses in the uterine wall, so that a hysterectomy would almost certainly have been successful.

In most cases requiring operation for puerperal sepsis an abdominal hysterectomy is advisable, with or without saving of the appendages as the case may require. Objection has been offered to this operation that all the pathology is not removed and that such incomplete operation would be of little or no avail. That argument might have some weight were it not that the technic advised gives ample drainage of infected tissues not removed, and that the *vis medicatrix naturae* can be depended upon to do the rest.

I have seen no reason to change the classification of these cases of puerperal sepsis which I made in 1922. (1) This class constitutes the great majority of the cases; in these the infection is limited to the endometrium and practically all recover if let alone. (2) The infection has passed beyond the uterine cavity into the broad ligament, where an abscess forms which can usually be readily opened through the vagina with prompt recovery, or if neglected will discharge itself. (3) The infection goes to the pelvic peritoneum with a collection of pus in the culdesac, which also can be readily opened through the vagina. (4) The infection involves the subperitoneal tissue forming what the old writers described as "dry peritonitis." These cases promptly result fatally. (5) This is the class of cases considered in my paper of 1922 and in this. In some of these cases the infection is so fulminant and with so little resistance on the part of the patient that a prompt fatality is absolutely inevitable. A considerable number of these cases were reported in Dr. Holmes' famous essay on *The Contagiousness of Puerperal Fever.* Death occurs in some of these cases in a very few hours, and operation would necessarily be absolutely futile. Most of the cases, however, are not so acute and it is in those that operation is advisable.

Dr. Miller suggests the justifiability of laparotomy "as a last resort," but only when the case has become "frankly hopeless." This is interesting logic: forbid operation until the case becomes practically hopeless, and then, because of the large mortality, condemn the entire operation! The mortality of operations for intestinal obstruction is notoriously high, but no one condemns them on that account but rather urges earlier recognition and more prompt operation.

Some foreign surgeons, in making these hysterectomies, use the

Mikulicz tamponade when drainage is needed; that method, which I have used in a few abdominal cases in male patients, is infinitely inferior to the vaginal fluff drainage through the vagina which I have used in hundreds of hysterectomies for all forms of septic conditions. The Mikulicz drain is promptly surrounded by adherent intestines which thus predispose to postoperative ileus, and the delayed closure of the operative incision necessarily predisposes to postoperative hernia. By swinging the sigmoid around over the gauze fluff and attaching it to the peritoneum at the brim of the pelvis or just below, bringing over the cecum if the sigmoid is insufficient, the uncontaminated abdominal cavity is entirely separated from the infected pelvis. This gauze is withdrawn at the end of one week, after which vaginal douches are given as needed.

As to the operative technic: These patients are invariably in bad condition, and for that reason he only should undertake operation who is thoroughly familiar with the anatomy of the parts, who has a good working knowledge of gross pathology, and who has learned to avoid all false motions; he should not only have trained assistants, but should himself have had such an experience as will enable him to complete anything like an ordinary panhysterectomy in thirty minutes.

In case hysterectomy is found necessary, the cervix should invariably be removed, partly because of its probable infection but chiefly to have the vagina wide open for drainage. The round ligaments should be attached if possible to the margin of the vagina on each side, the posterior wall of the vagina split downward, and then the ends of liberal strips of gauze pushed down into the vagina, the rest of the gauze being made into a light fluff, not a *pack*, over which the sigmoid should be mobilized. Occasionally the infection will be found to have extended into one or both loins; in that case a strip of gauze should be firmly attached to the fluff and extended up to drain infected points. All of the gauze is to be withdrawn through the vagina at the end of one week. In very rare cases the infection may have extended so that there is an area above which cannot be safely drained through the vagina; only in such cases should a drain be placed at the lower end of the midline incision.

In mobilizing the sigmoid, the operator should first bring the sigmoid down and spread it across so as at a glance to decide as to the amount of tissue with which he has to work. He should then commence on the left side, being careful to have no sharp angulation at that point, and by continuous suture unite the anterior peritoneum to the sigmoid, continuing the process around to the right side, where again he should exercise care that there is no sharp angulation of the sigmoid which might later produce obstruction. If an ovary has been saved it should be brought up above the sigmoid so that it will not be buried in adhesions beneath. The omentum should be brought down and very carefully ad-

justed so as to still further cover over and protect the line of the sigmoid suture.

Whatever tissue is removed, this usually being the uterus with or without its appendages, care should be taken to ligate merely the arteries, leaving the veins open for drainage of infected contents, the fluff being so introduced as to cover over these open ends.

The gauze strips used in making the fluff should preferably be of iodoform gauze, hastily rinsed in water so as to remove any excess of iodoform and squeezed with the hand so that the gauze is simply moist and therefore "greedy" to absorb.

A satisfactory diagnosis of conditions requiring operation can only be arrived at by thorough, and usually repeated, examinations of the patient. The symptoms of metritis, as Dr. Miller so freely states, so closely simulate those of endometritis that positive differentiation is seldom possible until autopsy, but the persistence of grave symptoms might readily justify such a diagnosis as would render operative intervention not only wise but actually demanded. The operator, if in charge of the case, should make repeated and very careful bimanual pelvic examinations. The tender spots should be located and carefully studied at each subsequent examination. Records of pulse, temperature, blood counts, etc., should be examined meticulously, and a study of the patient's facial expression and mental condition should not be overlooked, as the facies might well be the determining factor in deciding as to operation. The quality of the pulse should be carefully considered as well as its mere rapidity. Finally, if in doubt, a diagnosis for operative purposes should be arrived at, as for any other purpose, by exclusion.

In conclusion: Diagnosis should be made more promptly in these cases, and can be made if the obstetrician will give each case personal and most careful study.

From the results obtained in ninety cases it seems evident that the diagnosis having been made, operation as radical as may be necessary to remove infected tissue, with ample drainage for that which must necessarily be left behind, will give a very satisfactory percentage of recovery.

ANATOMY OF THE FEMALE PELVIS AND PERINEUM IN RELATION TO LABOR

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THE term pelvis, as we shall use it in this paper, will be applied to the true pelvis or the pelvis minor, which is that portion of the abdominal cavity lying below the pelvic brim or linea terminalis and above the pelvic diaphragm. For purposes of anatomic completeness it would be necessary to discuss in connection with this space a floor and anterior, posterior and lateral walls; but for the purposes of this paper we deem it necessary to discuss only the floor.

The pelvic floor or pelvic diaphragm is composed of both muscle and fibrous elements. The fibrous element is the so-called endopelvic fascia. The endopelvic fascia is a continuation of the general fascial lining of the abdominal cavity being continuous over the iliopectineal line with the fascia descending over the psoas major muscle. This fascia passes down the lateral wall of the pelvis, over the obturator internus muscle to a line extending from the back of the body pubis backward to the spine of the ischium, being attached to both of these points. Along this line, which is known as the arcus tendinous, the fascia divides into two layers, and from the angle thus formed the greater portion of the levator ani muscles take their origin. The inferior layer of this fascia again divides into two layers, one of which clothes or covers the inferior surfaces of the levator ani muscles, thus forming the medial wall of the ischio-rectal fossa. The superior or medial layer of this pelvic fascia covers the inner or medial or superior surface of the levator ani and coccygei muscles becoming continuous across the midline with a similar layer of the opposite side thus forming a hammock-like fascial structure supported on each side by the corresponding arcus tendinous. This layer of fascia is known as the visceral layer of the pelvic fascia because it is the layer that is so intimately associated with the pelvic viscera.

We might think of the lower portion of the pelvic viscera, namely, the bladder, the urethra, the vagina, and the rectum as piercing this hammock-like structure. Thus, we see this layer of visceral fascia serving as a very important support for these organs.

It might be advisable to mention some special thickenings of this fascia. Thus, we have anteriorly the pubovesical thickening which is attached both to the body of the pubis and lower portion of the bladder. Then another thickening known as uterovesical is found binding

the lower portion of the uterus and upper portion of the vagina very firmly to the lower part of the urinary bladder. Still farther posteriorly is found another portion of the visceral fascia known as the rectouterine thickening which firmly binds the lower portion of the uterus and upper portion of the vagina to the wall of the rectum. That portion of this fascia through which the cervix passes is very firmly united with the fibrous portion of the cervix.

The parietal layer of the pelvic fascia passes around the anterior border of the levator ani muscles, blending in the midline, forming the superior fascia of the urogenital diaphragm.

The muscular layer consists of the levator ani and coccygei muscles, the muscular fibers being enclosed by the two layers of the endopelvic fascia, as just described. The coccygei muscles take their origin from the pelvic surfaces of the ischial spines and sacrospinous ligaments and are inserted into the lateral borders of the lower two pieces of the sacrum and upper two pieces of the coccyx. The levator ani muscles have a threefold origin. The anteroinferior fibers take origin from the posterior aspect of the body and superior rami of the pubes. The posterior superior fibers take their origin from the pelvic surfaces of the ischial spines. The intermediate fibers take their origin from the angle formed by the two layers of the endopelvic fascia, as previously described, or from the arcus tendinous or white line.

The insertion is as follows: the anterior fibers pass downward and backward, a few of them are inserted into the central point of the perineum; others are inserted into the wall of the anal canal between the external and internal sphincters. The intermediate fibers sweep around into the angle between the posterior wall of the rectum and upper end of the anal canal where they unite with their fellows of the opposite side and form a strong muscular collar about the gut. The posterior fibers pass backward and medially and are inserted into the median anococcygeal raphe and into the lower part of the coccyx.

The perineum which is the space lying below the pelvic diaphragm may be subdivided into two parts, the anal triangle and the urogenital triangle, the dividing line extending through the perineal body between the ischial tuberosities just anterior to the anus. The anal triangle has passing through its center the anal canal, having a space on either side known as the ischiorectal fossa which contains an extensive pad of fat, pyramidal in shape, through which extend vessels and nerves for the supply of the anal canal.

The urogenital triangle which is more important than the anal triangle to the obstetrician will be detailed more. This space contains the so-called superficial and deep pouches. The superficial pouch is the space enclosed between Colles' fascia superficially and the inferior fascia of the urogenital diaphragm deeply. Within this space we have the bulbocavernosus muscle, the ischiocavernosus muscles and the

superficial transverse perineal muscles and the vessels and nerves that supply these structures and the labia majora. In addition to these structures we have in this space the clitoris, the bulb of vestibule, Bartholin's glands and the terminal portion of the urethra and vagina. The deep pouch lies between the superior and the inferior fascia of the urogenital diaphragm. The superior fascia, which is a part of the endopelvic fascia, has been previously mentioned.

The inferior fascia is the fascia bridging between the inferior rami of the pubes and lies in the morphologic plane as the obturator membrane. Within this pouch we have the sphincter of the membranous part of the urethra, the deep transverse perineal muscles, the deep branches of the perineal nerves, dorsal nerves of the clitoris and the trunk of the internal pudendal arteries and a portion of the urethra and the vagina.

The lack of knowledge of the structure of the female pelvis is one of the fundamental causes of not recognizing complications during labor, the inability to correct this condition and to adequately repair injured tissues. To visualize the progress of labor one should know the muscular structure, the lymph and blood vessels of the uterus, the morphologic difference between the upper and lower uterine segments, the ligaments that attach the uterus to the walls of the pelvis, the parietal and visceral fascia which may blend or join with the muscular fibers of the cervix and uterus. How can one visualize the mechanism of labor without a knowledge of the levator ani muscles and fascia and their origin and insertion and their relation to the pelvic organs? Without this knowledge how can one hope to prevent injuries to the muscles and fascia of the superficial and deep structures of the perineum, and, if injured, repair them? The physiology and mechanism of the first stage of labor is better understood when it is known that the oblique muscular structures of the uterus are arranged in the form of a figure-of-eight around the blood vessels and are capable of powerful constriction, and, when contracted, produce intrauterine pressure.

The visceral fascia of the levator ani muscles is a part of the pelvic floor. This fascia in its morphologic development moors the uterus by the cervix to the pelvic wall. In this structural handiwork the pubovesical, the uterovesical and the uterosacral ligaments are mere thickenings of the visceral fascia and together attach or anchor the uterus to the bony structure. The visceral fascia joins or blends with the fascia of the fibers of the cervix. The visceral fascia attaches the bladder to the anterior surface of the cervix and lower part of the uterus and is considered with the uterus and rectum as pelvic organs.

The blending of the visceral fascia with the cervical fibers of the uterus and their fascia forms an important structure in the physiologic and mechanical part of labor. The fibers of the oblique or middle muscular layer of the uterus pass obliquely from the peritoneal surface of

the uterus to the endometrium. E. Hastings Tweedy says, "As these fibers approach the internal os, they turn almost at right angles, passing out and attaching into the pelvic wall as muscular tendons." He further says, "The circular fibers of the cervix likewise terminate in muscular tendons and they, too, largely attach themselves to the bony wall of the pelvis." Tweedy emphasizes the fact that "Involuntary muscular fibers may have muscular tendons as well as any other muscle, and if this were not so during the first stage of labor, the visceral fascia of the pelvic floor would be completely destroyed."

Dr. W. W. Looney, Professor of Anatomy, Baylor University, College of Medicine, says, "The visceral pelvic fascia serves as an aponeurosis for the oblique and cervical fibers instead of these muscle fibers having independent muscular tendons, which, Tweedy states, 'are inserted into the bony pelvic surface.' Probably as the visceral fascia passes to the uterus and cervix it blends with the fascial covering of the muscle fibers of these structures. This explanation appears more plausible when the visceral fascia is considered a part of an extension of the fascia covering the psoas muscle." Anatomists say that the dissecting of the individual fibers of the nonpregnant uterus is a difficult task, and that probably as the oblique fibers approach the cervix, these may become more circular and form what is known during labor as the contraction, retraction or Bandl's ring.

The uterus requires more space for the growing embryo about the seventh month of pregnancy. This space is supplied by the pushing down of the contents of the pregnant uterus against the internal os which causes these oblique fibers to dilate and retract, producing what is later known as the lower uterine segment. This segment is not necessarily taken from the cervix, for in the nonpregnant uterus the oblique and circular fibers are closely associated with each other as if they were compressed, and it is difficult to dissect them. A study of the anatomy of the uterus suggests that the lower uterine segment probably is developed from the fibers of the middle layer of the uterus which are present just superior to the internal os and bounded superiorly by Bandl's ring. This anatomic space of the uterus is the potential lower uterine or dilating segment.

The lower uterine segment is formed before the onset of labor. During the first stage of labor as the uterus contracts and forces the fetus against the internal os, the fibers of the lower uterine segment pull out and up on the circular fibers of the cervix, causing them to dilate. As has been said, "As the uterus contracts, the cervix dilates." This causes the shortening of the cervix which previously has not been very perceptible, yet the cervix may have been shortened by the irregular and painless contraction of the uterus before the onset of labor. As the cervix dilates, beginning at the internal os and extending to the external os, this progress is spoken of as effacement, and the gradual

progress is considered favorable during labor. The cervix may be completely obliterated or effaced before the external os is perceptibly opened. Especially in a primipara is this progress more favorable in the prevention of lacerations of the cervix than a thick or long cervix opening up in its entirety. During the first stage of labor, the fetus has not been pushed through the cervix, but rather the cervix has been pulled back over the presenting part, taking with it the bladder. As effacement takes place, the cervix is retracted over the presenting part, carying with it the bladder, which previously has been a pelvic organ and now becomes and later will be an abdominal organ. This is an important point in the diagnosis of the close of the first stage of labor and the entering into of, and during the second stage of labor. This is a point to be considered if catheterization at this time is necessary. A full bladder during any period in labor may prevent full contractility of the uterine fibers. Bearing down while the bladder is a pelvic organ should be prevented to avoid tears of the uterovesical fascia and injury to the trigone and sphincter urethrae and urethra, which may cause a cystocele.

The pelvic floor is composed of the levator ani muscles and the visceral fascia which extends across the lower part of the pelvis, hammock-like in shape, and supports the nonpregnant uterus, and, also, during pregnancy, the head during labor. The course of the head during labor from the pelvic floor is downward and upward. A definite rule in the mechanism of labor is that the lowest point of the head is rotated to the front under the pubes by the levator ani muscles and the visceral fascia. The pelvic floor pushes the lower part of the head to the front, and the suboccipitobregmatic diameter which was in the oblique diameter now lies in the anterior posterior diameter of the outlet. It is the levator ani muscles, their shape and contractility which cause rotation during labor. The levator ani muscles and the uterine muscles oppose each other as they contract, which is clinically demonstrated as the head passes over the perineum and underneath the symphysis. Extension takes place while the uterine muscles contract; and, when ended, the head is flexed by the levator ani muscles pushing the head back. Probably the levator ani muscles lose their power to flex the head after the biparietal diameter has passed through.

The perineum is the structure that receives the force of labor after the head has passed through the pelvic floor. Lacerations can occur anywhere in the birth canal and may be submucus in character, located in the sulci or in and around the perineum, even including the sphincter ani. If the levator ani muscles and their fascia are not congenitally weak, or have not been overstretched, or have not been torn, these structures will support the uterus and prevent its prolapse. The uterus is supported by the pelvic floor and is not suspended from above.

A tear in the sulci probably will involve the anterior fibers and a few intermediate fibers of the levator ani muscles and their fascia. A destruction of the anterior and intermediate fibers and their fascia which are inserted into the central point of the perineum and anal canal and posterior to the rectum will deprive the rectum of this support. With the loss of this support and by the contraction of the sphincter ani the lower part of the rectum is pulled back forming a more acute angle which enlarges the ampulla, and this, in turn, will cause, during defecation, the feces to go against the posterior wall of the vagina rather than follow the anal canal and form or cause a rectocele. If the tear is in the anterior sulcus, the anterior fibers of the levator ani muscles with their fascia will be involved and destroy the support for the bladder and anterior vaginal wall and cause the base of the bladder together with the anterior wall of the vagina to sag and form a cystocele. The tear may begin in the vagina above the perineum, extending outward separating the muscles and fascial structures down to and including the sphincter ani. A median laceration through the perineal body does not involve the fibers of the levator ani muscles and their fascia except a few of the anterior fibers attached in the central point, and this would injure the perineal diaphragm but little. This tear would only partly destroy the supporting action of the superficial transverse perineal muscles, the bulbocavernosus and the urogenital diaphragm. Rupture of perineum alone will not cause prolapse.

Perineotomy or central incision of the perineum will prevent or control extensive lacerations. In a perineotomy only a few tendinous insertions of the levator ani muscles are divided, the muscular fibers themselves escaping because they are superior to the central point of the perineum. Lateral episiotomy may be preferred by some; but the danger of severing, if extensive, the fibers of the levator ani muscles and their nerves might later cause atrophy of the muscles. The stretching or "ironing out" of the perineum, the levator ani muscles and their fascia to prevent a tear is illogical and not a surgical procedure, and this is incompatible with the new era in obstetrics, that of prophylaxis. We teach a technic that will prevent infection. We emphasize the value of rectal examinations as preferable to the vaginal in order to prevent infections and to ascertain the progress of labor. I sometimes fear we are overzealous in making rectal examinations and consider these examinations as totally void of danger, yet there is a potential danger. Rectal examinations are safer than the vaginal, but it is not logical to advocate rectal examinations instead of the vaginal and then practice "ironing out" or stretching the perineum to avoid lacerations. If vaginal examinations are a source or an avenue for infections, then surely manual dilatation of the vaginal tissues is poor surgical procedure and probably more hazardous than several

vaginal examinations, and not only is this method a source of infection, but may rupture the fibers and fascia of the levator ani muscles and cause prolapse, cystocele and rectocele. Since the uterus is supported by the pelvic floor rather than suspended from above, this overstretching or breaking of the muscular fibers may cause weakening of the support of the uterus and result in a prolapse, while perineotomy causes less injury to the tissues and is not so great a source of infection.

CONCLUSIONS

1. The lack of knowledge of the structures of the pelvic tissues is one of the fundamental causes of not recognizing complications during labor, the inability to correct these conditions and to adequately repair injured tissues.

2. The visceral fascia serves as an aponeurosis for the oblique and cervical fibers of the uterus and cervix. As the visceral fascia passes to the uterus and cervix, it probably blends with the fascial covering of the muscle fibers of these structures.

3. During the first stage of labor the bladder is a pelvic organ; and after effacement, complete dilatation and retraction the bladder becomes an abdominal organ. Bearing down while the bladder is a pelvic organ may cause tears of the uterovesical fascia and injury to the trigone, sphincter urethrae and urethra of the bladder, and may cause cystocele. An injury of the uterovesical fascia may cause prolapse of the base of the bladder; and injury to the sphincter urethrae or Bell's muscles may cause urine to collect anteriorly to the base of the trigone.

4. A tear in the sulci will probably involve the anterior and a few intermediate fibers of the levator ani muscles with their fascia and deprive the rectum of this support and cause rectocele.

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REFERENCES

Cunningham: Manual of Practical Anatomy, ed. 7, 2: pp. 147-197. *Tweedy, Wrench, and Solomons:* Practical Obstetrics, ed. 5, pp. 7-9 and 591-595, Oxford University Press, 1925.

MEDICAL ARTS BUILDING.

THE RÔLE OF THE THYROID IN DIFFERENTIAL DEVELOPMENT

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NO CHILD with abnormal thyroid function can make normal progress along the lines of differential development. The other ductless glands as well as the thyroid are influential in promoting normal development. The thyroid gland, however, is the pacemaker, the regulator of physical and mental differential development, the belwether or leader of the endocrine or ductless glands.

Few realize the very great prevalence of thyroid insufficiency in the human being, and the resulting effect upon health and character. Thyroid insufficiency ranges through all degrees from entire absence of thyroid function which results in utter idiocy, to the extremely mild forms of thyroid deficiency, in which the patient shows only very mild or almost imperceptible, deviations from the normal.

The cretin or the individual totally deprived of his thyroid gland is an idiot and a dwarf. He will never, no matter how long he lives, measure more than three feet in height, and will, throughout the course of his existence, remain an infant in mentality.

I wish to call your attention especially to the influence of thyroid deficiency in the mother upon the differential development in the later life of the child. Let me explain briefly the terms "gross" and "differential" development as used in this discussion.

Gross development refers to increase in size. Differential development includes all the changes, both physical and mental, that occur in the process of evolution from the time of conception until the individual reaches full maturity. It includes not only all the embryologic changes that occur during fetal life and such later phenomena as the eruption of teeth, the ability to talk, the change of the voice, the appearance of a beard, sex characteristics, etc., but it also includes the development of the intellect, the power to reason or think with judgment, and the development of character qualities. Thus, differential development is not complete at puberty but at full maturity. Different characteristics normally develop in successive stages. Some belong to fetal life, some to childhood, some to the "teens" and some to the twenties. Memory, imitative faculties, affection impulses develop at an early age; conscious sex impulses develop about the time of puberty. Imagination develops early; control of harnessing of the imagination comes later as judgment and reason act as a bridle on the imaginative faculties.

Almost automatic responses to the environment in early childhood normally yield to control by the reason or the will late in the teens. After adolescence during young manhood and young womanhood comes the final and most important stage of development from the standpoint of citizenship. Character qualities become a part of the individual himself. Truthfulness, honesty, justice, kindness, courage and judgment developed within himself, a part of himself, govern every impulse, decide every action. He is dependable, what we call "settled." With the prophet he can say, "When I was a child, I spake as a child, I understood as a child, I thought as a child, but when I became a man, I put away childish things."

Normal differential development is a continuous process by which physical, intellectual, mental, and moral perfection is attained. The later stages of differential development follow the early stages, the human baby that is born with a normal differential development is already well on the road to healthful maturity and has a much better chance in the race of life than the baby whose development at birth is retarded.

It has long been known that thyroid function must be effective in the early stages of the life cycle if the organism is to reach its normal development. From the standpoint of perfect differential development in the later stages adequate thyroid function is of more importance during fetal life than during any later stage of development. The baby born with retarded development may, if provided with adequate thyroid function at an early age, apparently reach the normal, but he can never quite reach his inherent possibilities. Unfortunately, the result of thyroid deficiency in the mother may not be obvious until the child has reached the age of adolescence, too late to speed up differential development.

The cretin alone is not the index of economic loss in the community. He is but the torch-bearer of the incompetents, the absolute zero of intelligence. In his wake and outnumbering him many times, follows the army of cretinoids—the weak-minded and imbeciles, the sluggards and misfits, the misshapen and deformed, the deaf-mutes and the degenerates, the criminals, unfortunate representatives of every phase of decadence from the zero of the cretin to degrees of mentality and physique barely below the normal.

It is impossible to estimate the prevalence of the milder forms of physical and mental underdevelopment due to lack of thyroid function. Many of them attain almost normal physical and intellectual power but are lacking in moral and character qualities.

According to Wm. Nelson, of St. Louis, 85 per cent of youthful criminals have an intelligence quotient of above 50 and below 81.

According to Hirschfield, "Of the eleven million recruits examined in the late war, 45 per cent were found to have a mentality of not

much over twelve years." True morons (adults with a mentality age level of from seven to twelve years) are generally peaceful and law-abiding, readily satisfied with conditions as they exist, but prone to idleness, and may easily be led into mischief. The real menace is the "psychopathic personality" or the "constitutional inferior," "morally rather than intellectually inferior," whose vicious tendencies are easily veiled, "until by heedlessness or lack of foresight, he leaves detectable evidence of his crimes." John Wilkes Booth, who shot Lincoln was a "psychopathic personality." Davy Herold, the half-wit who was with him when captured, was a moron dominated by Booth.

I do not wish to infer that all criminals are morons or subnormals. Jesse James was perhaps a normally developed individual. He was reared in an atmosphere of passionate hates, resentments and suspicions. He perhaps reacted normally to the cruel, vicious, madly lawless environment of his boyhood.

The Loeb-Leopold case, however, presents another angle. Environment alone cannot explain their criminal characters. They had reached a physical and intellectual development far beyond the average. But their moral development was greatly retarded. Differential development had not progressed beyond the age level of fourteen years.

Is retarded or defective differential development in these cases due to conditions within our control? Shall we leave this problem to psychologists, educators, religious enthusiasts, social workers and faddists of all kinds, or shall we give it serious thought and consideration? The retarded development in many cases can be shown to be the result of thyroid insufficiency in early life. The large group of defectives and morons, those who show slight deviation from the expected standards, who are slow to learn, finding themselves invariably at the foot of the class, who are given to truancy, who seem normal but are not, who promise but do not keep their promises, who try but do not succeed, cannot hold their jobs, are a burden and source of constant anxiety to their parents, are prone to yield to criminal impulses, these constitute the greatest social and civic problem that confronts us today.

Can the medical profession, in the light of present knowledge, by preventive measures, especially during pregnancy, reduce the incidence of criminals and dependents from incompetency, psychopathic personalities, idiocy, insanity, etc.? Can we go further and reduce the incidence of morons and high-grade mental defectives? Can we go even further and by prevention of thyroid deficiencies in pregnant mothers and growing children enable the coming generation to more nearly approach perfect differential development?

The results attained by appropriate treatment directed toward speeding up the differential development in children attending special schools for backward children are very encouraging. There is hardly a medical practitioner who does not see several backward children

each year; about 95 per cent of all these children are appreciably improved by thyroid medication, but in no such case can one hope to attain the results possible by earlier attention to the deficiency.

Thyroid insufficiency may be due to:

1. The faulty functioning of the thyroid gland itself.

2. Mineral deficiency in the body.

The human body requires over 13 mineral elements, some of which are iron, calcium, magnesium, iodine, sulphur, etc. The most important of these, from the standpoint of thyroid function, is iodine. But deficiency in any of the above minerals may interfere with normal thyroid function. Some of the causes of mineral deficiency are,

(a) Lack of mineral elements in the nutritional supply.

(b) Defective assimilation whereby the mineral elements in the nutritional supply are not utilized.

(c) Excessive elimination of one mineral element as the result of an effort to eliminate another. The most common deficiency of this type is an iodine and sulphur deficiency caused by an excessive amount of magnesia and calcium in the water supply.

3. Infections are of some importance, because they produce disturbances in assimilation.

SIGNS AND SYMPTOMS

I. *History.*—First, and of most significance, is the history. A family history of goiter, idiocy, obesity, mental deficiency, enteroptosis, criminality, degeneracy, late teething, walking, or menstruation; and a personal history of the above plus weight history, school record, temperamental peculiarities, intelligence quotient, etc.

It is often difficult to obtain the above family history even though the patient realizes its importance. The incidence of demonstrable thyroid insufficiency in the third generation of goitrous individuals is usually more than 50 per cent.

II. *Obesity.*—A family history of obesity is of slight significance unless associated with a history of subnormalcy in the family.

III. *Enteroptosis.*—As a family trait it should be considered. I have been convinced that enteroptosis in some cases is the result of retarded differential development in early fetal life by observation of many cases like the following:

One mother, with adenomatous goiter, gave birth to two extremely enteroptotic children both dull mentally. Her hypothyroidism was discovered and she took thyroid extract regularly for four years during which time two children were born that are not enteroptotic and are very active mentally. Then her goiter was removed and she discontinued thyroid medication. Two years later she gave birth to the fifth child that is subnormal mentally and extremely enteroptotic. When this fifth child was six months old, she sought treatment for well-marked myxedema.

I know of four enteroptotic children born to thyroidectomized mothers, while older children from the same parents are not.

IV. *Infantilism.*—The possibility of hypothyroidism should be considered when an expectant mother presents an infantile physiognomy, small teeth, receding lower jaw, small stature, undeveloped breasts and secondary sex characteristics, obesity, thin hair, thickened skin, puffed face or abnormally thick broad tongue.

V. *Sluggishness.*—The pregnant woman normally becomes overenergetic, overactive, and overambitious during the early months of pregnancy.

The pregnant woman who becomes apathetic, increases in weight rapidly, has puffiness of the face and swelling of the legs, who is inclined to become inactive, should be suspected of being hypothyroid.

VI. *Vomiting.*—The greater majority of cases with persistent vomiting of pregnancy can be shown to be deficient in thyroid function.

VII. *The Breasts.*—Lack of evidence of colostrum or secretion in the breasts the last few days of pregnancy almost always accompanies hypothyroidism. Suppression of milk after confinement is an indication that should be considered.

BASAL METABOLISM

The basal metabolism rate is generally estimated in the same way and given the same interpretation during pregnancy as if the woman were not pregnant. The accepted normal variations, as determined by oxygen consumption, are based upon established ratios of oxygen consumption to the factors of height, weight, age and sex. These ratios have been determined with sufficient accuracy to be generally accepted in medical literature and no doubt serve their purpose well in the estimation of variations from normal basal metabolism except in cases of pregnancy. Fever, digestion, exercise, etc., are factors that influence the rate of oxygen consumption and must be given consideration in determining the basal metabolism rate. Pregnancy is another factor and should receive due consideration. If we are to properly estimate the rate for the pregnant woman, we must adopt higher ratios of oxygen consumption and give more consideration to such factors as pregnancy, fever, vomiting, digestion, emotional states, etc.

While most authorities agree upon an increased rate of oxygen consumption, the normal increased rate during pregnancy, or the rate for different months of pregnancy has not been even approximately standardized.

Many cases of hypothyroidism in pregnant women have been overlooked because their metabolic rates have been reported normal, no attention having been paid to the fact that the normal reading during pregnancy is probably twenty or thirty points higher than would be found in the same woman if she were not pregnant. For instance, a

plus ten during the third month of pregnancy might have been a minus fifteen before conception took place.

We know that the oxygen consumption rate runs a very irregular course during pregnancy. There is no other condition known in which there is such a great variation both as compared to the nonpregnant and the degrees of change of rate in the various months of pregnancy. However, we are convinced that it is always increased; the hypothyroid woman will nearly approach, or even surpass the accepted normal rate, and the woman with a normally functioning thyroid will give a high reading, sometimes reaching a point reported as plus 40 or 50 per cent. About one-half or more of the cases will run such a varied course of metabolic rates, with such sudden rises and falls, that not even an approximate estimation can be set down as the usual one, but in about 40 per cent of the cases we have found a fairly constant reading. Assuming the normal nonpregnant reading, we find a gradual increase with the onset of pregnancy, which at the third or fourth month reaches an increase of about twenty above the nonpregnant reading or plus twenty. This which is so often accepted as high, we believe to be normal under the existing circumstances. From the third or fourth month to the termination of pregnancy, there is no further gradual increase, but rather the maintenance of a fairly constant rate which averages twenty to twenty-five points higher than was found before pregnancy occurred. We do, however, find sudden increases for perhaps three or four days, such as plus fifty or sixty, but they usually recede and remain within limits of the constant level. From this we conclude that if the basal metabolic rate is to be taken as a criterion or guide for treatment, new tables with higher percentages should be adopted as well as further investigations made of the probable factors which cause such great variations in the basal metabolism rate in pregnancy.

TREATMENT

Treatment consists largely in the administration of thyroid and in the correction of mineral deficiencies. Valuable adjuvants are phototherapy, change of climate, hygienic measure, etc.

In the administration of thyroid, large doses are rarely necessary. The amount required daily may usually be given in one dose. One-half to one grain of thyroid extract per day is sufficient for the usual case.

The correction of mineral deficiencies requires more thought and study. Fortunately iodine the most important mineral is easily assimilated in almost any form. It may be given in the form of Lugol's solution, five to ten minims twice a day. A more attractive preparation is one-tenth grain of iodoform in tablet form. It is almost tasteless and this dose is equal in effect to five minims of Lugol's solution.

When thyroid medication is poorly tolerated, investigation will usually show that some mineral deficiency exists. In my experience, the most frequent one except iodine is sulphur. Sulphur, phosphorus, iron and some of the other minerals are not absorbed in the natural state. Sulphur may be given three times daily in the form of one grain of ichthyol with glycerin in capsule, with fair prospects of absorption. In calcium deficiency one to two grains of calomel in divided doses once a week and calcium lactate 90 grains per day seems effective. Light therapy is a valuable adjuvant. There are several preparations on the market containing varying combinations of the different minerals in a form that the manufacturers claim to be assimilable.

THE TEACHING OF POSTGRADUATE GYNECOLOGY

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IN DISCUSSING the pedagogic problems involved in the subject under consideration, it is necessary to differentiate three groups of candidates for postgraduate instruction: (1) those who take a special internship in obstetrics and gynecology after completing a general intern service; (2) graduate interns who are selected by universities, foundations, etc., for supplemental courses, embracing from one to three additional years; and (3) practicing physicians who present themselves for concentrated instruction after a variable number of years in practice, general, surgical, or gynecologic, seeking to extend and improve their diagnostic and therapeutic resources.

In striving for his degree, the undergraduate's interest is mainly academic. He has not a proper conception of the relative importance or clinical significance of the scientific data that he is absorbing, and often suffers from an intellectual indigestion. He acquires his clinical experience in gynecology chiefly in the dispensary, where the number of students and limited time necessarily restrict the development of his diagnostic ability and therapeutic judgment. Witnessing pelvic operations from the remote benches of the amphitheatre, he sees a great deal of hardware and dry goods, but learns little gynecologic pathology. The refinements of technic are concealed, although the apparent safety and simplicity of the procedures are alluring. Consequently, the finished product of the undergraduate school, even without subsequent hospital training, does not hesitate to wave sharp curettes in the uterine cavity and attempt vaginal plastic operations. In some large cities such practices by the inexperienced are facilitated by the existence of many uncontrolled private sanitaria and

open hospitals. One way to mitigate this evil is to curtail the undergraduate demonstration of major surgical operations.

It is distressing to note that gynecology has not yet been divorced from the department of general surgery in a number of large hospitals. Such a state of affairs prevails today in three prominent institutions in my own city. Two of them operate separate out-patient gynecologic clinics, but neither has produced a trained gynecologist in the past twenty years. Hospitals tolerating this anomalous arrangement are failing in their duty to their interns, to the medical profession, and to the public. The departmental fusion of obstetrics and gynecology is not only logical but highly desirable, because the intelligent practice of one is dependent upon a thorough knowledge of the other. But there is no more reason for the absorption of the gynecologic operative material by the department of general surgery than for the appropriation of all patients requiring otolaryngologic operations. In the latter specialties, as well as our own, the ability to do operations is relatively unimportant, as compared with the proper selection of cases for operation and expertness in applying nonoperative treatment. It requires more skill to cure diseases of women by conservative measures than by operation, and it is far more creditable to the gynecologist, and certainly to the patient's advantage, if symptoms are relieved by office treatment rather than by hysterectomy. During the year 1928, 23,157 visits were made to the gynecologic clinic at the New York Postgraduate Medical School and Hospital. This number included 2,864 new patients, of which only 228, about 8 per cent, were operated upon. Of course a few drifted to other institutions and a small number refused operation, but the average of loss was no greater than in private practice. That many general surgeons are skilled pelvic operators is freely admitted. On the other hand, their capacity for duly considering the adaptation of treatment to pelvic symptomatology, the effects of particular operations on the child-bearing function, and the important factors that subsequently influence the patient's psychologic stability and domestic happiness, is open to question. As a rule, the background of a wide obstetric experience is lacking. How many utilize diathermy, the electrocautery, negative galvanism, pessaries, cystoscopy, radium, etc.? Those who can find the time and have the inclination to accord all these items the attention they merit, while carrying on a general surgical practice, are to be congratulated. I have no inclination to read an indictment of the general surgeon as a pelvic and plastic operator, but I have the temerity to challenge his teaching of gynecologic therapy.

An intern is but a medical student with a degree, which allows him to assume certain responsibilities while pursuing his clinical studies. He has a right to assume that the members of the attending staff will guide his instruction and encourage him to cultivate habits under their

supervision which will contribute to his future professional success. He is entitled to practical training on a separated obstetric and gynecologic service as the first step in his postgraduate instruction. During the past few years there has developed a crystallization of sentiment among teachers that the departments of obstetrics and gynecology should be amalgamated in all teaching institutions. Why not in all hospitals?

An intern securing a service in a hospital devoted exclusively to diseases of women is fortunate, as these institutions are few in number and such opportunities are necessarily limited. Hospitals of this character usually make their selections from aspirants who have completed a general intern service elsewhere, and thus continue the training of men who already are fairly well qualified for private practice.

Up to the present time, most university medical schools providing postgraduate instruction have sought and chosen the more brilliant students for a prolonged apprenticeship, eventuating in either a competent research worker or a capable teacher. Perhaps the Mayo Foundation best exemplifies this system. Dr. Louis B. Wilson, Director of the Foundation, is authority for the statement that after an existence of fourteen years, 70 per cent of its graduates are teachers. Parenthetically, it may be noted that there is no separate gynecologic department in the Mayo Clinic. The candidates for these intensive courses are usually between twenty-five and thirty years of age, have had no contact with patients on an individual basis, and sacrifice little in continuing their institutional studies. The research worker and teacher are essential to progress in the science of medicine, and the necessity for ultrascientific postgraduate instruction in their development is unquestionable. But whether men of this type have a real inclination and the personal qualifications for private practice is problematical.

All physicians of long experience have discovered that irrespective of the specialty practiced (except general surgery), the majority of patients demand relief from minor and nonoperable ailments. Even when an operation is under advisement, sound surgical judgment is just as important as the details of technic. It is therefore quite natural that many practitioners frequently realize the desirability of postgraduate work, after a few years in the hard school of practical experience. The New York Postgraduate Medical School and Hospital was founded in 1882, with the chief purpose of providing facilities for such postgraduate studies. In the forty-seven years of its existence, 27,158 doctors have registered as matriculates. If it is logical to assume that the postgraduate student's requirements reflect the deficiencies of his undergraduate and intern instruction, my observations seem to justify the inference that the undergraduate student has had too much mental exercise and training of the memory, with too little

synthesis of ideas, and an unduly restricted practical experience in gynecology. During the ten-year period from June 1, 1919, to May 31, 1929, 7,291 matriculates registered in the school. Of these, 1,290, or 10.7 per cent, took courses in gynecology. I have utilized the statistics of a recent ten-year period rather than those of the past forty-seven years, because they are more enlightening in respect to the need of the present-day practitioner. Only three other departments registered more matriculates than the department of gynecology: otolaryngology 1,595, urology 1,359, and laboratory 1,319. In other words, more physicians with actual experience in the trials and tribulations of private practice voluntarily sought postgraduate instruction in gynecology than in medicine, surgery, pediatrics, or neurology. Of the matriculates taking gynecologic courses, 766 stayed one month, 379 two months, 134 three months, and 11 six months; these figures indicate the actual demand for intensive instruction compressed within as short a time as possible. One hundred and eighty-three took the seminar, a schedule which entirely fills the student's time from 9 A.M. to 5 P.M., six days a week. This comprehensive teaching schedule provides for cooperation with the departments of pathology, biologic chemistry, proctology, and dermatology. The remaining 1,107 took one or more special courses: diagnosis and office treatment, operative gynecology on the cadaver, female cystoscopy, endocrinology, etc. Of course, many of the latter group also took special courses in other departments. Despite the sentiment in favor of long postgraduate courses, culminating in a finished specialist with an additional degree, the fact remains that many active practitioners have no specialistic ambitions, and cannot afford the sacrifice of time and expenditure of money incidental to a prolonged absence from home. Yet they are sufficiently conscientious in the realization of their deficiencies to make every endeavor to improve their professional skill. Leaving their practices and curtailing their incomes, even for a short time, it is hard to believe that such men would unjustifiably pretend to be something which they are not. Our school confers no degrees, grants no diplomas, and issues no certificates, beyond a written statement on request, that the matriculate has taken a certain course of instruction. In each instance an effort is made to adapt the curriculum to the past experience, desires, and ambitions of the individual, after an inquiry to determine his qualifications. Admitting the advantages of long courses for potential specialists, it also seems logical to make some provision for the man who may not be intellectually brilliant or desirous of specializing, but who feels the need of "brushing up." It must be conceded that practice in the field of gynecology does not involve the use of so many diagnostic refinements, instruments of precision, and highly specialized technic, as a few of the other branches of medicine. Hence, the directors of some other departments are in a better position to demand

that their matriculates spend more time in the pursuit of their studies. From the pedagogic standpoint, an ideal for the future in the gynecologic department would be the limitation of courses to those matriculates who are planning to specialize and can remain in the school for at least six months, but this is impracticable until undergraduate and hospital training equips the practitioner in such a way that the demand for short courses will be materially diminished.

CONCLUSIONS

1. There are three groups of candidates for postgraduate instruction in gynecology: those who seek an internship in special obstetric and gynecologic hospitals; recent graduates who take supplementary intensive courses leading to an additional degree; and physicians in active practice who voluntarily present themselves for postgraduate instruction.

2. It is the business of undergraduate schools to prepare their students for the practice of medicine.

3. The teaching of the refined technic of major surgical procedures might well be curtailed in undergraduate schools.

4. A special gynecologic service should be conducted in all hospitals.

5. The departmental fusion of obstetrics and gynecology is highly desirable.

6. Fellowships and long courses of more than one year produce more teachers and research workers than practitioners.

7. At the New York Postgraduate Medical School and Hospital, during the past ten years, more matriculates have sought postgraduate instruction in gynecology than in any of the other branches of medicine, except otolaryngology, urology, and laboratory.

8. Of the 1,290 matriculates taking gynecologic courses during the past ten years, 59.4 per cent stayed one month, 29.4 per cent two months, 10.4 per cent three months, and 0.8 per cent six months.

580 Park Avenue.

A CRITICAL STUDY OF 335 HYSTERECTOMIES

(Done From September 1, 1928, to September 1, 1929)

By James E. Davis, M.D., and Paul L. Cusick, M.D., Detroit, Mich.

HOSPITAL RECORDS

THE scientific attitude in hospital work would be measurably improved if there were an obligatory requirement for a yearly, five-yearly and ten-yearly group study of at least 5 per cent of the major standardized surgical operations. Improved studies of cases would be a natural result; a more efficient system of record making would follow; availability of the records would be improved; a worth-while follow-up system would be supported. Through all this work there would be developed the use of important common factors which would effectively aid in the welfare of patients and efficiency of surgical services.

The clinical records studied, in almost every instance, have given no worth-while record of constitutional data. Further investigation of hospital records in other cities has shown that the staff is not required to make adequate records of facts pertaining to the patient's constitution. Necropsy findings are repeatedly proving that many patients are being numbered as mortalities because they were not properly safeguarded before operation by carefully directed constitutional studies. No better example can be cited than the patients with vascular and organic scleroses. Such patients when subjected to anesthetics from one and one-half to three hours are demised in from four to eight or nine days. The clinical reasons for the deaths may appear inadequate, but pathologic examinations reveal an astonishing frequency of vascular and organic scleroses of both hereditary and acquired origin.

Clinical history records very frequently show deficient statement of the preoperative diagnosis. The descriptive data concerning the operation in many instances is concerned more with the operative technic than with the living pathology observed or exact statement of the tissue removed. This type of record is of little value to the patient or the surgeon six months later when the patient declares no relief has been obtained, for then the busy surgeon has forgotten exactly what was done within the patient's abdomen, and on consulting the record finds only the technic described in the last operation.

The follow-up problem involves expense and painstaking effort, which has no immediate tangible value in hospital financing. Its value must be credited to the patient and the doctor. Certain obligations, however, are arising which make it mandatory that patients shall be

followed through periods of many years. The surgical, as well as the x-ray and radium, treatment of cancer can only be evaluated by knowing the patient's condition five or more years after treatment if curative data are desired. Even the after-history of the patient who has had only an appendix vermiformis removed may often be profitable information. And even the finest technic in perineorrhaphy may need to be followed to determine results.

EFFICIENCY OF OPERATORS

Clinical and pathologic studies show too large a group of inadequately trained operators. Technical efficiency is surprisingly good, but differential diagnostic knowledge and appreciation of unexpected pathologic conditions are often inferior. The surgery of these operators is a real menace to the patient's safety, except on occasions when the expected changes are present.

Observations concerning the most efficient and experienced operators show all too frequently insufficient attention for the safety of the patients. When two ways are possible for the patient to be directed in getting well the one of risk is often chosen for no better reason than it is the surgical way. The operator who feels he must have the greatest number of hospital patients is too frequently disposed to this practice.

It is quite exceptional, even among the better class of surgeons, to find many who are good readers of gross pathologic tissue changes, and it is quite exceptional to find a single surgeon in a large city who can read histopathologic tissue changes. To determine whether a uterus or a kidney should be removed calls for knowledge of living pathology in addition to judgment upon operative indications; and what better opportunity is there to improve and fortify this knowledge than is afforded by close and careful gross and microscopic studies of the tissues removed?

MATERIAL STUDIED

The data for this study have been gathered from 335 patients upon whom hysterectomies have been performed in six different hospitals by thirty-five different operators.

The gross and microscopic tissues afforded a unit study, divided into two parts; one part, consisting of 256 cases, was personally studied by the senior author; the remaining 79 cases by O. S. Brines, and then reviewed by us in this paper. Gross specimens in the majority of instances were studied by serially sectioning the entire tissue. Permanent mountings were made of a serial cross-section from each separate type group by curing in Kaiserling III solution.

Histopathologic examinations were made of two to four selected sections from each gross specimen, and certain details of the study were followed as uniformly as possible throughout the entire group of cases.

In uteri involved in fibromyomatous newgrowths, changes found in the myometrium, endometrium and cervix were recorded. The common factors in the architecture of the tumor masses, together with changes denoting inflammation, degeneration and malignancy, were observed and described. In uteri without newgrowth changes particular attention was given to recognition of pregnancy, infection and degenerative changes, particularly of the vascular structures. In specimens exhibiting malignant newgrowth, extent of involvement, degree of malignancy and changes in the uterus of a general character were noted. Uterine adnexal tissues removed were routinely examined for existing pathology.

ANALYSIS OF CASES

The civil and social conditions of the patients represent a mixed group from one city hospital and five private hospitals. Ninety-six and five-tenths per cent of the patients were married women; 56 per cent of these patients have given birth to one or more children.

Two races were represented, in the following proportion: white 69.1 per cent, negro 30.9 per cent.

The average of age incidence of the white patients was 39.65 years and of the colored patients 33 years.

CONSTITUTIONAL DATA

The records have been found almost of no value for this information. Fatness and leanness of the patients were only occasionally noted. Remarks concerning body build were seldom found. Heredity received no attention. Temperamental developments were scarcely mentioned.

SYMPTOMATOLOGY OF FIBROMYOMATA (SUBJECTIVE SYMPTOMS)

Abdominal and pelvic pain, while not recognized as a symptom by most textbooks, occurred much more frequently in our series than any other symptom; while other effects as menorrhagia, leucorrhea, etc., when they occurred were earlier in their appearance. It seemed that it required the presence of actual pain to drive these patients to a physician and, subsequently, to operation. Pain in the abdomen occurred in 65 per cent of this series of cases and was a chief complaint in 54 per cent. Backache was present in 33.1 per cent and was the chief complaint in 16 per cent. The mechanism of pain production was of two types. First, that due to pressure upon nerves and plexuses of the region; and second, irritation produced by the tumor in the uterus itself. Both types usually were more severe at the menstrual period due probably to the accompanying hyperemia.

Menorrhagia, given as the most frequent and important symptom by Graves,[1] Kelly[2] and others, occurred in about one-third of the cases

and as the chief complaint in but 6 per cent. Menorrhagia and metrorrhagia were more frequent in the submucous type of growth. Metrorrhagia occurred in 24.6 per cent of our cases.

Leucorrhea occurred in 33.18 per cent of this series of cases. This symptom is produced according to Fulkerson[3] by a hyperplastic endometrium, which in turn is due to passive congestion.

Pressure symptoms, such as frequency and constipation, were variable and dependent on the size and position of the growth.

Dysmenorrhea, given as the earliest indication of fibromyomata, by Kelly,[2] was found in 11.6 per cent of our cases, being the chief complaint in but 5.4 per cent.

DETAILED LISTINGS OF SUBJECTIVE AND OBJECTIVE SYMPTOMS IN 233 CASES OF FIBROMYOMATA

A. SUBJECTIVE	PER CENT OF ALL CASES	
1. Pain in abdomen or pelvis	65.0	(Textbooks do not list pain as a predominant symptom)
Chief complaint in	54.0	
2. Tumor in abdomen	40.8	
Chief complaint in	29.0	
3. Backache	33.1	
Chief complaint in	16.1	
4. Leucorrhea	33.18	
Chief complaint in	6.7	
5. Menorrhagia	31.3	(Almost all writers list menorrhagia and metrorrhagia as chief symptoms)
Chief complaint in	7.6	
6. Metrorrhagia	24.6	
Chief complaint in	16.0	
7. Dragging—sense of weight	22.9	
Chief complaint in	6.2	
8. Frequency of urination	25.0	
Chief complaint in	2.2	
9. Constipation	21.9	
Chief complaint in	1.8	
10. Irregularity (menstrual)	20.6	
Chief complaint in	1.8	
11. Dysmenorrhea	11.6	
Chief complaint in	5.4	
12. Burning on urination	13.0	
Chief complaint in	1.35	
13. Headache	11.6	
Chief complaint in	2.7	
14. Retention of urine	2.7	
Chief complaint in	0.45	
15. Incontinence	0.9	(2 cases)

B. OBJECTIVE	PER CENT OF ALL CASES
1. Tumor palpable in abdomen or pelvis	47.0
2. Cardiac disturbance	13.35
3. Anemia	9.4
4. Leucocytosis	9.4
5. Thyroid disturbance	8.9

AGE INCIDENCE

The age incidence for the group of fibromyomata is of greatest significance between 30 and 50 years. From 20 to 30 years there occurred 11.6 per cent; 30 to 40 years 43.4 per cent; 40 to 50 years 39 per cent of the cases. Between 50 and 60 years only 5.4 per cent and after 60 years the number reached almost the vanishing point or 0.6 per cent. The average age of white patients exceeded that of colored patients by 6.65 years.

Correlation of the most common factors, in fibromyomata, will yield very usable data to give a very high average of correct diagnosis:

Abdominal or pelvic pain was present in 65 per cent of all cases and as a chief complaint in 54 per cent of all cases, taken together with backache which occurred in one-third of the patients, and then associated with palpable tumor formations which had a 47 per cent frequency, should be taken as the most significant grouping of symptoms.

Bleeding (menorrhagia, metrorrhagia, with associated congestion and dysmenorrhea) and the correlated cardiopathology, anemia and thyroid dysfunction formed the second grouping and next most frequent symptoms.

The triumvirate of fibromyomatous symptoms may be recorded as *pain, tumor* and *bleedings.*

OPERATIONS

In this group of 335 hysterectomies there has been either total or subtotal resection of the uterus without adnexal structures, or with parts or all of the adnexal structures. Myomectomies are not included. In 72.16 per cent of cases the uterus was removed because of the presence of fibromyomata. Malignancy was found in 6.09 per cent of cases; retained products of pregnancy in 6.4 per cent of cases; and inflammatory changes with associated hypertrophy and hyperplasia in 26.8 per cent of cases. (Endometrial infection 15.5 per cent; myometritis 4.5 per cent; cervicitis 5.8 per cent.) There were also three cases of tuberculosis of the endometrium; there were ten other uteri with only arteriosclerotic changes, and sixteen of descensus.

The treatment of fibromyomata, so far as this material is concerned, has been entirely surgical. There is not a single instance in the records of x-ray or radium treatment having been given for this type of pathologic change. The great majority of specimens show multiple tumor masses of medium size, which would seem to indicate, when compared with the tumors removed in the earlier period of hysterectomies for fibromyomata, that a better control of this condition is being obtained. However, a considerable number of advanced degenerations in many cases have been observed in this group. The type of operation performed was predominantly subtotal for the removal of fibromyomata. It has seemed that from the number of infections found in the

tissue adjacent to the cervical stump, that total extirpation would have been better treatment. James F. Baldwin[4] and others have insisted that the cervical portion of the uterus should be removed as insurance against continued infection and possible malignancy, and that its removal does not necessarily interfere with vaginal and bladder support. The incidence of safety in this series of cases is expressed in a mortality rate of 4.68 per cent.

The operations for malignancy would appear to have been unsatisfactory, particularly where the cervix was involved. The specimens show that sections were made through the cancer masses and no particular attempt had been made at removal of all the cancerous tissue, or the use of supplementary radium and x-ray treatment. The work of Adler[5] of Vienna, and his results in vaginal hysterectomy followed by radium and x-ray treatment of cancer of the cervix are exceedingly gratifying and should be known to every operator. The work of Bonney,[6] of England, and others, using the Wertheim technic in all stages of cancer of the cervix has been attended by as low as 15 per cent to 18 per cent mortality. Again, the records of radiologists and roentgenologists like Kelly[2] and Burnham,[11] Schmitz,[7] Regaud[8] and Strachan[9] have been excellent, and the results of their well-standardized technic in treatment should be made known to all operators for this type of malignancy.

PATHOLOGY—GROSS AND MICROSCOPIC

Tumors.—In 72.16 per cent of the uteri fibromyomatous newgrowths were observed, and in only a few instances were these growths not visible for gross recognition. A small number of seedling or microscopic tumors was observed.

Eighty-six per cent of the fibromyomata were multiple. This finding will suggest the futility of myomectomy as a treatment.

Fifty-seven per cent of all the fibromyomata gave gross evidence of degenerative changes.

Fourteen and three-tenths per cent of all the fibromyomas were undergoing liquefaction, 3.5 per cent exhibited red degeneration, 7 per cent calcification, 3.1 per cent were necrotic, 2.5 per cent were infected and 0.6 per cent malignant (sarcoma).

Uterus.—In 65 per cent of all cases there was atrophy and displacement of the myometrium. (If sections had been taken from all parts of the wall, this percentage would be much too low.)

Vascular sclerosis was a very constant finding in 80 per cent of the tissues. Diffuse fibrosis was observed in approximately 60 per cent of specimens. Hyperplastic and macerated endometrium was present in approximately 70 per cent of all tumor cases.

DISEASE ENTITIES OTHER THAN FIBROMYOMATA

Only two types of pathologic changes were found in which fibromyomata were not present in some of the cases.

Hydatid mole occurred in two uteri in which there were no fibromyomata; one tubal pregnancy was unassociated with fibromyomata.

Endometritis, descensus uteri, recent pregnancy, marked vascular sclerosis, cervicitis, myometritis, sarcoma, carcinoma, adenomyosis and tuberculous endometritis occurred more or less frequently in association with fibromyomata.

In the uteri without fibromyomata there were 24 instances of endometritis; 15 of descensus uteri without associated fibromyomata; 15 recent pregnancies without fibromyomata; 19 cases of marked vascular sclerosis of the uterus; 15 cases of cervicitis, one of which showed an associated recent pregnancy; there were 7 malignancies of the cervix and fundus without fibromyomata; 5 instances of adenomyosis without fibromyomata; and 2 cases of tuberculous endometritis not associated with fibromyomata.

The ovarian pathology, which is based entirely on the adnexal tissue removed, occurred in 11.3 per cent of all cases; salpingitis occurred in 8 cases not associated with fibromyomata.

The age incidence of the pathology other than fibromyomata corresponds very closely with that of fibromyomata, being 33.5 per cent from 20 to 30 years; 23.5 per cent from 30 to 40 years, and 27.5 per cent from 40 to 50 years. The incidence from 50 to 60 years was 8 per cent, and from 15 to 20 years and beyond 60 years 4.5 per cent.

DISCUSSION

Historical Development of Hysterectomies.—Hysterectomy is an operation of recent development. In earlier times leeching was considered very good treatment. Absorbents were used later for all types of uterine tumors.

Amussat[10] inaugurated a practice of cutting the uterine neck to control hemorrhage due to fibroid tumors.

In 1853 Burnham,[11] of Lowell, Massachusetts, performed the first successful operation by laparotomy for fibroid tumor.

In 1853 W. T. Atlee[12] presented a paper before the American Medical Association entitled "The Surgical Treatment of Certain Fibrous Tumors of the Uterus, Heretofore Considered Beyond the Resources of the Art." This article won the prize of the association.

It is also claimed that Freund[13] of Germany performed the first hysterectomy for fibroid tumor. The date, however, given for this operation is later than 1853.

In 1865 Professor Hildebrandt[14] of Königsburg inaugurated the ergot treatment of fibrous tumors. This treatment was used with some degree of success and was advocated as late as 1891 by Goodell[15] of the University of Pennsylvania.

In 1880 Cutter[16] of Boston reported 50 cases of fibromyomata treated by electropuncture; 32 of this number are said to have been benefited; 4 died, and 4 were believed cured.

As late as 1891, when hysterectomy was considered "an heroic measure," incision of the capsule of the fibromyomata was done by introducing a knife through the cervical canal, and then the tumor was dislocated from its bed. Bilateral oophorectomy was another operation of considerable popularity as late as 1891, because this resulted in atrophy of many of the tumors.

Hysterectomy at first was attended by an unusually high mortality, but of recent years many operators consider the mortality rate as practically nil.

Radium treatment has gained the confidence of many surgeons and radiologists because of its low mortality in carefully selected cases.

Clark[17] and later Polak[18] have quite definitely stated the contraindications for the use of radium.

Masson,[19] W. J. Mayo,[20] Bonney,[6] and Hertzler[21] regard myomectomy as preferable to radium in selected cases. Bonney[6] reports having successfully removed as many as eighty myomata from one uterus. The same operator reports removing as many as seven myomata from a pregnant uterus without disturbing the pregnancy.

Tumors of the uterus have been mentioned by Hippocrates[22] in his *Second Book*. Moschion[23] and Octius[24] have also written concerning tumors of the uterus.

Akakia,[25] at one time professor in the University of Paris, in his *Treatise on Female Disease*, advised that abortion be produced if the uterus contained a chronic tumor, condyloma or steatoma.

Smellie,[26] in 1772, mentioned glands and scirrhous tumors producing difficult parturition.

Hysterectomy for Cancer.—Cancer of the fundus uteri, except in advanced stages, has been most successfully treated by hysterectomy. Edward J. Ill[27] and others, have reported satisfactory results over many years. This treatment appears superior to other methods.

The treatment of carcinoma of the cervix is at present advocated by three different methods. Bonney[6] of England and others still advise the Wertheim abdominal operation; and Bonney's statistics show a death rate for all types of cases beyond the five-year period of 15 per cent to 18 per cent. Adler[5] of Vienna has reported a thousand operations by the vaginal route, and since employment of local anesthesia vaginal hysterectomy with radium or x-rays combined has given results hardly reached and surely not surpassed by any other treatment. The combined treatment by hysterectomies and radium showed results, after five to six years, of 58.8 per cent recoveries; without radium 42 per cent of recoveries. The patients living after three years, treated by hysterectomy and radium, were 72 per cent and without radium 60.9 per cent; and after two years there were 92.8 per cent of the patients living who had been treated by vaginal hysterectomy and radium, and 72 per cent without radium. Adler[5] has insisted upon pushing back the ureter with sterile gauze and inserting the radium beside the gauze and adjoining the lymph node involved area of the broad ligament. Over a period of ten years he reports his relative cures of 58 per cent and absolute cures of 32 per cent. By relative cures is meant a comparison of patients cured with those operated upon, while absolute cures indicate the number of permanent five-year cures compared with the total sum whether operable or inoperable.

SUMMARY

The diversified material supplied in this group of cases for the past year from Detroit hospitals, when checked up against stated indications for treatment by hysterectomy, may invite some adverse criticisms.

In answers from a questionnaire sent to prominent gynecologists of United States and Canada one learns with some degree of surprise how great is the diversity of opinion and practice among leaders in this type of work. The question asked was "What percentage of your hysterectomies have been performed for the removal of myomata or fibromyomata of the uterus?"

The answers gave an average of 71.6 per cent of all hysterectomies having been done for the removal of fibromyomata. This compares closely with the percentage 72.15 for our group of 325.

This average of the questionnaire answers resulted from three grades of percentages, one from a group between 10 and 35 per cent, another between 65 and 75 per cent and one between 90 and 100 per cent. One operator treated all fibromyomata by myomectomy. Other operators did hysterectomies only for fibromyomata. The majority, however, did hysterectomies for fibromyomata in about 72 per cent of their cases. The remaining 28 per cent of the operations were for hemorrhages related or unrelated with recent pregnancies, for infections of the uterus and adnexa, for malignancies of fundus and cervix.

The tabulated findings of this study show in conclusion:

1. Hysterectomy is the prevailing operation of choice for fibromyomata of the uterus averaging approximately 72 per cent in this study and in the clinics of 45 of our leading operators in this country and Canada.

2. Approximately 30 per cent of uteri are removed for malignancies, inflammations, hyperplasias, and malpositions.

3. The prevailing symptoms of uterine pathology for which relief is sought are pain, tumor, and bleeding.

4. The combined use of hysterectomy and x-ray or radium is a treatment of great promise in all types of uterine pathology, especially for cancer of the cervix.

REFERENCES

(1) *Graves:* Textbook of Gynecology, Philadelphia, 1928, 4th ed., W. B. Saunders Co. (2) *Kelly:* Textbook of Gynecology, New York, 1928, D. Appleton & Co. (3) *Fulkerson:* Textbook of Gynecology, Philadelphia, 1929, p. 216, P. Blakiston & Co. (4) *Baldwin:* Tr. Am. A. Obstet. Gynec. and Abdom. Surgeons 36: 158, 1923. (5) *Adler:* J. Obst. & Gynec. Brit. Emp. 36: 335, 1929. (6) *Bonney:* J. A. M. A. 87: 1530, 1926. (7) *Schmitz:* Tr. Am. A. Obstet., Gynec. and Abdom. Surgeons 36: 89, 1923. (8) *Regaud:* J. de radiol. et d'electrol. 9: 561, 1923. (9) *Strachan:* J. Obst. & Gynec. Brit. Emp. 36: 367, 1929. (10) *Amussat:* Diseases of Women, Thomas and Munde, Philadelphia, 6th ed., p. 524, 1891. (11) *Burnham:* Ibid. p. 526. (12) *Atlee:* Ibid. p. 527. (13) *Freund:* Volkmann's Sammlung klin. Vorträge, April 3, 1878; Am. J. Obst. 11: 648, 1878. (14) *Hildebrandt:* Diseases of Women, Thomas and Munde, Philadelphia, 6th ed., p. 525, 1891. (15) *Goodell:* Am. J. Obst. & Gynec. 10: 560, 1925. (16) *Cutter:* Diseases of Women, Thomas and Munde, Philadelphia, 6th ed., p. 525, 1891. (17) *Clark and Block:* Am. J. Obst. & Gynec. 10: 560, 1925. (18) *Polak:* J. Obst. & Gynec. Brit. Emp. 36: 325, 1929. (19) *Masson:* J. A. M. A. 87: 1530, 1926. (20) *Mayo:* J. A. M. A. 87: 1530, 1926. (21) *Hertzler:* Private answer to a questionnaire. (22) *Hippocrates:* Guy's Hosp. Rep. 13: 71, 1841. (23) *Moschion:* Guy's Hosp. Rep. 13: 1841. (24) *Octius:* Guy's Hosp. Rep. 13: 71, 1841. (25) *Akakia:* Guy's Hosp. Rep. 13: 71, 1841. (26) *Smellie:* Guy's Hosp. Rep. 13: 1841. (27) *Ill, E. J.:* Tr. Am. A. Obstet., Gynec. & Abdom. Surgeons 36: 182, 1923.

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NONMALIGNANT BREAST CONDITIONS, DIAGNOSIS AND TREATMENT

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THE evolution of the mammary gland which dates back into the distant past was a momentous event, Wall reasons, "in that it ushered in a period when the care and education of the young by the mother became a prominent feature of life." The evolution of this gland stimulated mental development in the offspring. When an infant is able to shift for itself soon after birth, its instincts will be sufficient for its needs, and therefore its mental advancement is slow and uncertain.

The histology of the breast varies throughout life according to many conditions. Usually at the time of birth, and continuing for about five days thereafter, the infant's breast is capable of lactation. Syms describes it as "having been activated by the corpus luteum at the time the mother's breast was activated." Soon thereafter, the breast is found to be a rudimentary organ.

Throughout childhood but little alteration takes place. At the time of puberty change occurs in the breasts of both sexes, and in the female this change is progressive and lasting. The milk spaces are amplified, distention occurs at the end of the ducts, with a formation of acini, which are grouped in the formation of a lobule. This group of acini, with their ducts, is joined in the final milk canal and constitutes a glandular unit. With the occurrence of the first pregnancy, evolution takes place, and the gland becomes an active organ.

After lactation has ceased, involution sets in with a diminution of the size and number of acini and rehabilitation of fat. With each pregnancy a similar cycle occurs.

With the occurrence of the menopause comes the final involution or atrophy of all of the essential elements of the breast.

Such are the normal breast developments in the female from birth to involution. The abnormal and pathologic conditions of the human breast are many, and it is my purpose to present some of the most frequent of these nonmalignant conditions with suggestions as to their diagnosis and treatment.

Among the congenital abnormalities, perhaps the rarest is agenesia, a complete absence of both breasts, including the nipple. Cases have been reported by Mouchet, Young, and others. Polymastia, the presence of more than two mammae, is less rare as is also polythelia, the occurrence of more than one nipple on a mamma. Aberrant breast

tissue, with or without nipple formation, may be found occasionally at remote sites of the human body. Such fragments of breast tissue, anatomically shut off from the normal breast outlet, have been known to cause tumefaction at the new site.

Many theories have been advanced to account for extra breasts on the human, but Darwin's idea that polymastia is a reversionary phenomenon, based upon the theory of evolution, seems to many as good as any theory—outside of Tennessee!!

Extra mammae appear on the sculptured forms of Diana of Ephesus, and it seems an accepted fact that Anne Boleyn had three distinct breasts. If modern plastic surgery could have been applied to her chest wall, the unfortunate lady might have retained her head, thus changing the trend of English history, a fact which even Hackett seems to have overlooked in his recent brilliant biography of Henry the Eighth.

Gynecomastia (excessive growth), precocious development, or massive hypertrophy are conditions usually easily diagnosed. A luetic background or an endocrine dysfunction must be duly considered in practically all of these cases. Iodides or other antiluetic treatment, where such is required, or glandular therapy in endocrine dysfunction are the therapeutic measures indicated in the majority of these conditions.

In April, 1925, Dartigue of Paris described his brilliant technic for cases of extreme breast overdevelopment or elongation *(Arch. franco-belges de chir.)*, and Noel and Lopez-Martinez *(Arch. franco-belges de chir.* 31: 138, 1929) also have an interesting technic for these cases. The latter correct extreme elongation by crescentic excisions in the skin of the breasts immediately over and partially surrounding the areola. The resulting scar blends with the areola and is quite imperceptible. If the elongation is more than 10 cm., the operation is completed by similar small crescentic excisions under the areola. These small crescentic skin excisions, made under local anesthesia, are repeated as often as is necessary for complete correction of the pendulousness. For breasts sagging more than 14 cm., the Lopez-Martinez technic of nipple transplantation is used instead of the above technic.

Dartigue's present technic for plastic restoration of the breast gives astonishingly fine results as I witnessed recently in Paris.

When we approach the benign pathologic processes of the adult human breast, our subject must be confined to very definite limits. In this discussion of the diagnosis and treatment of some of these conditions of the mammary gland (the treatment of the most frequent abnormalities of congenital, endocrine and luetic origin I have already briefly mentioned) there are two points which I particularly wish to emphasize. These are: (1) the necessity for thoughtful and exact differential diagnosis in neoplasms of the human breast (and such diag-

nosis must include the recognition and elimination of those basic factors, whether endocrine, toxic or infective and whether external or internal which might lead to progressive pathologic change in the gland); (2) the right of the patient to demand conservation of the mammary gland and preservation of the breast contour where possible.

Such points as these might seem almost too obvious to emphasize among medical men, but it is not long since an eminent surgeon said "that he would today submit every portion of a breast with a blue dome cyst to careful microscopic examination, and any breast, it made no difference what the gross appearance, where there existed one or a dozen cysts, regardless of the size of the cysts, should always be examined with the microscope."

In answer to this statement, another surgeon responded "that he did not care how the diagnosis was made, but if a whole breast must be had for examination, how could the breast be saved? This 'take out' policy would mean the mutilation of every woman with a lump in her breast."

Another authority says, "When the question arises between chronic mastitis and carcinoma, it is usually the safest procedure to remove the breast and . . . . . if no malignant process is found, one has merely removed a menace to the patient."

The following statement is also quoted from the writings of a recognized authority who believes "that every benign tumor of the breast should be removed before it has an opportunity to become carcinomatous." In other words, it should be removed as soon as recognized.

In such instances as these—what of the patient?

Two other points which are outside the range of a paper on benign lesions of the breast but which, when discussing the breast, I feel it imperative to mention are these: (1) the searching need for the greatest care in the manipulation of the breast during examination, since metastasis may be artificially produced by massage of a malignant tumor, and this may occur as readily during the early stage in the development of the neoplasm as later; (2) the necessity for radical and adequate surgery where such measures are indicated. Faulty technic, thorough though the surgical procedure may be, is too often the cause of the dissemination of neoplastic cells.

The wide variations of even the most frequently encountered benign neoplasms of the mammary gland are among the most difficult features of differential diagnosis. These variations are emphasized recently by the extensive campaigns of cancer publicity which are bringing to physicians people with early pathologic conditions—lesions so small, in many cases, as to present few of the clinical signs of their particular tumor classification. While from the standpoint of cancer prevention, such early observation is desirable, an added responsibility in the mat-

ter of diagnosis rests upon the surgeon—a responsibility which he must be prepared by education and experience to meet adequately.

One of the main causes of abnormal change in the breast tissue is due to irritation, and when I say irritation, I mean not alone the external factors which cause inflammatory conditions but those processes which arise from endocrine dysfunction, metabolic disturbances, or toxic elements in the system altering the blood which bathes the fixed cells of the body.

Extrinsic irritation may be, of course, of traumatic or various other origins. Chronic irritation is produced either by repeated trauma to the tissues or in the form of chronic inflammatory processes. In trauma of the breast the final pathology may be but an indirect result of the original injury. Following a severe blow, there may be a tearing of the glandular tissues with resultant hematoma. This may be absorbed in part as evidenced by change of color over the area. Following the absorption of the cellular elements of the blood, the residue, serous or serofibrinous material, may become organized and form a distinct lump—a real mass of scar tissue which, surrounded by glandular cells, will cause irritation. No one can gauge the final result of a severe trauma of the breast, nor its potentialities in the development of malignancy of the mammary gland. McWilliams showed that in 100 consecutive cases of carcinoma of the breast observed at the Presbyterian Hospital, New York, 44 per cent gave a history of antecedent local trauma. W. B. Coley, in an analysis of 120 cases of carcinoma of the breast personally observed, showed a trauma percentage of 42.33.

It is generally conceded today that chronic irritation of either intrinsic or extrinsic origin, as indicated above, may be the forerunner of mammary carcinoma. Doctors Adair and Bagg have recently published a paper dealing with the relation which chronic irritation bears to the etiology of mammary carcinoma, and their data would seem to show that the relation between stasis of the female breast secretions and cancer of the mammary gland is of vital importance. The experiments were made upon a carefully inbred strain of mice with low tumor incidence. The females were divided into two groups, one serving as a control was allowed to suckle its young. The mammary ducts of the other group were ligated *on one side*. In the control group, the incidence of tumor growth was less than 5 per cent. The group in which the ducts were ligated, showed nine females (the group consisted of fourteen female mice) with mammary carcinoma on the ligated side. While it must be remembered that mice are not men, these facts call for our thoughtful consideration.

Whether chronic mastitis is of infectious origin, the result of basically toxic factors or a disturbed metabolism can scarcely be said to be clarified by the amount of literature on the subject.

The differential diagnosis between chronic mastitis, with a more or less localized lobulation and an actual, definite lesion of the mammary gland should not prove a difficult problem. In chronic mastitis, when the gland is examined between the thumb and the forefinger or the area of lobulation rolled with the flat of the hand against the chest wall, irregular, unsymmetrical masses, sometimes painful, but usually tender, are felt, as well as the more strictly localized mass which was probably the cause of the patient's visit to the surgeon.

With a diffused mastitis, elimination of pelvic or intestinal pathology in the patient may cause the inflammatory condition to recede. The most important phase of the mastitis is its etiology in relation to the development of tumors of the breast. Ewing says that "the condition begins as an inflammation and often ends as a neoplasm." He finds that a large proportion of mammary cancers occur in breasts which are the seat of chronic mastitis and agrees with Cheatle that chronic mastitis is a very important predisposing condition to mammary carcinoma. Adair and Bagg state that "we have noticed such constant association between chronic mastitis and cancer of the breast that we conclude that the malignant condition is only one step farther in the pathologic process."

For many years the present writer has been emphasizing the direct relation between chronic intestinal toxemia and a lobulation of the mammary gland. Cases have been reported again and again of "lumpy" breasts—even breasts with well-defined tumors—which have been restored to normal by the elimination of the toxic condition of the intestinal canal.

In view of the fact that there seems to be an increasing amount of evidence which points to a connection between these "lumpy" breasts (whether of toxic, inflammatory or infectious origin) and malignancy of the mammary gland, it might be well to cite one or two cases where results have proved beyond doubt the relation of the intestinal stasis to the breast pathology.

CASE 1.*—L. F., female, aged thirty-five years, married, two children.

First seen in March, 1920, for retraction of and eczematous discharge from left nipple; considerable lobulation of the upper, outer quadrant of the breasts; two small glands in left axilla.

Previously to consulting me the patient had seen two well-known surgeons, one of whom had advised radical operation, writing to the family physician, "I would urgently advise the removal of both breasts."

After careful examination of the patient, and weighing all the aspects of the case, I advised that a course of preliminary treatment, under careful observation, be given. A brassiere to relieve all pull on the upper, outer quadrant was prescribed; bicarbonate of soda baths; alkalies internally and high colonic irrigations.

Within three months the lumps in the axilla had disappeared entirely; the breasts were less lobulated; the discharge had lessened materially; the eczema about the areola had disappeared; the feel of the breast was normal, and the general condition of the patient was excellent.

*Preliminary report Medical Press and Circular, Feb. 9, 1921.

After three years there was no return of the breast pathology, and the patient is no longer under observation.

CASE 2.—A. B., female, aged twenty-five years, widow, two children. This patient had always been constipated. In March, 1915, she commenced to have pain in the right lower quadrant of the abdomen. In December, 1915, a lumpy condition of the breasts developed, with a bloody discharge from both nipples and this discharge was present when the patient consulted me in February, 1916.

There were glandular lumps in the upper outer quadrant of the breasts. Examination of the abdomen showed distinct tenderness in the right iliac fossa, along the head of the cecum and over the appendix.

X-ray diagnosis showed this to be a case of chronic intestinal stasis, for which abdominal plastic operation was performed.

Following the operative procedure on the intestinal canal, the lumps in the breast disappeared, as did also the bloody discharge from the nipple.

Today, fourteen years later, the patient is in perfect health, and the breasts are normal, although the patient had been sent to me for double breast amputation.

There is no question but that abnormal changes in the breast tissue occur as the result of intestinal toxemia in many patients. Chronic irritation from toxins in the blood constantly bathing the glandular tissue is doubtless a competent cause of inflammatory change and lobulation of the breast—a competent producing cause of mastitis. These toxic breasts, the result of poisoning from the intestinal tract, classify themselves into two groups: (1) those with generalized lobulation, frequently associated with prescribed tumors; (2) those with localized degeneration and in addition an adenoma or cystoma.

The treatment of all of these cases must be directed toward eliminating any focus of infection. Gastrointestinal fermentation should be corrected if necessary, by diet, digestives, intestinal antiseptics, often alkalies, colonic irrigations in some cases, and other therapeutic measures as indicated. Abdominal supports may be necessary in cases of relaxed abdominal walls until, by cultural care through special exercises, the tone of the abdominal muscles is restored and the enteroptotic tendency overcome. The above regime and the proper support of the breasts, in a number of instances, will cause the lobulation and associated tumefaction mentioned in group one to disappear. A few of these cases may require surgery of some part of the intestinal canal.

In cases of well-developed cystoma or adenoma, the breast tissue will demand conservative surgery. If the intestinal stasis is marked and persistent, it too may need surgical adjustment. However, I have had a number of cases in which tumors with all of the clinical symptoms of adenomas have diminished in size and finally disappeared following the plication of a mobile cecum, or the relief of intestinal folds or bands, which were causing a degree of chronic intestinal obstruction.

Pelvic infections are another source of danger to breast tissue. All of us have seen tender and lobulated breasts which became normal after the removal of badly degenerated and cystic ovaries, or after a curettage. The following is a case in point.

CASE 3.—A. S., female, aged thirty-two years, single. Two years before consulting me this patient had an operation for a uterine condition. In May, 1919, she came to me because of an irritation of the bladder, severe pain in the back and ovarian region, together with a lumpy condition of both breasts.

Curettage followed by laparotomy was performed, and a much-enlarged uterus with a considerable number of fungosities, a mass of adhesions which extended back of the uterus down to the culdesac, a fibrocystic right ovary, deep in the pelvic cavity, surrounded by a mass of omentum tightly adherent to the uterus in front and to the rectum behind, were found. The mass was about the size of two hen eggs.

The operative conditions were corrected, and by August, 1920, the lumps in both breasts had disappeared entirely. The patient is at present in excellent condition. The breasts are normal.

What proportion of these toxic breasts are precancerous remains a problem. Today we do not know whether cancer is due to a chemical reaction (in the host) which merely responds to an extrinsic irritation. In an article which was published in *Les Néoplasmes** I stated my belief that cancer is of multiplex pathology, and since that time I have had no evidence which has caused me to change my mind.

Many eminent physicians believe that "there is a constant association between chronic mastitis and cancer of the breast." Concerning the origin of chronic mastitis we are still in the twilight. Probably the elimination of pelvic, intestinal and other toxemias would greatly reduce our cases of mastitis and be a decided step forward in our cancer prevention campaigns.

Benign tumors of the human breast have been recorded throughout the course of medical history. An interesting allusion is that to a tumor in the breast of Atossa, daughter of Cyrus (B.C. 530). Atossa discovered the tumor but because of shame kept the condition a secret until it became so painful that she was forced to consult Herodotus. Unfortunately, details are lacking, which leaves the diagnosis vague, but it is evident that a periodic health examination, by competent advisers, might have saved Atossa much unnecessary suffering and later the deformity which history implies was her chief worry.

Tuberculosis of the breast, although rare, must be kept in mind, as there are mose cases than usually believed. The claim is made that it constitutes about 6 per cent of all well-defined benign lesions of the mammary gland. Infections may ascend from the nipple, by way of the ducts or lymphatics, may be hematogenous, or may arise through an extension of an infective process in the ribs or pleura.

*Les Néoplasmes 2: 5, 1923.

Dr. Nathan W. Green (in the *Medical and Surgical Report of the New York Hospital,* 1915) reports an interesting case of tuberculous mastitis in an active breast, following removal of carious teeth.

The patient was delivered of a normal child, March 3, 1914. In 1912 she came to the United States and shortly after her arrival had four teeth extracted. Two months following the removal of the teeth an abscess "behind the ear" developed, and then occurred lymphatic involvement of the neck, left axilla, area over the sternum and finally, involvement of the breast. A breast abscess broke after child-birth. This was opened and healed.

March 16, 1914, the breast was removed. After this, another lymph node became involved in the right axilla and broke down. This was opened and healed. Microscopic examination of the breast tissue showed "tuberculous mastitis in an active mamma." There was no pulmonary involvement. The relation between the removal of the teeth and the rapid involvement and extension of the infective process was very marked.

Toxemia from infected teeth or tonsils and inflammatory conditions of the mammary gland may be closely related. I have seen cases of lobulated breasts restored to normal following the removal of infected tonsils or teeth.

In tuberculosis of the breast, where chronic abscess and the formation of fistulas occur, with the enlargement of axillary lymphatics, the diagnosis is practically evident. However, where the differential diagnosis must be based upon the clinical examination of a few scattered nodules or one or more definite masses in the breast, the surgeon frequently needs all of his diagnostic acumen to decide the line of action. Tuberculosis may be associated with benign or malignant or other lesions of the breast. It is in such cases as these (where the condition may be a purely malignant one, or a malignant neoplasm associated with tuberculosis) that the greatest care must be exercised in examination of the breast so as to prevent the dissemination of neoplastic cells. Histologic, microscopic and animal inoculation may all be required to verify the diagnosis. The treatment, at the fistulous stage, may include disinfection of the sinuses with phenol, followed by alcohol, heliotherapy and rest and feeding, but when the tuberculous process is extensive, ablation of the breast tissue and inflammatory mass is the logical procedure.

The following case was sent to me as advanced sarcoma of the breast. My opinion was intended to confirm the hopelessness of any surgical procedure.

CASE 4.—M. C., female, fifty-five years of age, married. For three years the patient had had a hard nodular swelling in the left axilla with involvement of the breast. When I first saw the case, the mass was nearly the size of the entire breast and painful on pressure. The arm was painful and much enlarged. Two physicians had declared the condition to be sarcoma so advanced as to be hopeless.

After careful examination, I diagnosed the case as inflammatory, possibly

tuberculous, and decided to give her a chance by extensive operation. This was done. The pathologic report proved the condition to be tuberculosis.

The patient had an uninterrupted recovery, healing rapidly, and two years later was in perfect health. Since that time I have lost track of her.

Gummas of the breast may occur as infiltration, or as large well-defined tumors.

Bissell states that "gummata of the breasts have to be differentiated from cysts of the organ, from tuberculosis of the breast and from carcinoma." The writer believes that the chief difficulty of diagnosis is between gummata and carcinoma, since gummata frequently are painless, sharply outlined and of stony consistency. There may be no history of syphilis, or definite clinical symptoms. The Wassermann may or may not be positive.

Many diagnosticians grant the likelihood of an incorrect diagnosis in cases of syphilitic breasts and Keen's *Surgery* quotes Edward Martin to the effect that "the diagnosis from cancer may be quite impossible except from a consideration of associated symptoms and the result of therapeutic treatment." Adair states that "even those surgeons who see an extraordinarily large number of breast cases, have rarely seen a gumma of the breast." "The rarity of the condition," he continues, "is where the responsibility lies for its nonrecognition."

In the surgeon's mind, when doubt arises, a short course of antiluetic treatment may produce rapidly curative results. A provocative Wassermann may also prove a diagnostic aid, and we are coming to realize that many patients with a late syphilitic condition have bone changes which are revealed by the x-ray, in cases where the Wassermann may or may not be positive.

In a final analysis the experienced surgeon will remember that retraction of the nipple remains an early indication of malignancy in some cases, and that in more advanced types, the lymph nodes become involved in the area of the primary lesion and not, as may be true in syphilis, at remote sites.

CASE 5.—P., female, fifty-five years of age. This patient gave a history of having been well and strong until two years before consulting me when she commenced having discomfort, more or less continuous, in the upper outer quadrant of the right breast.

Examination showed enlargement of the sternal ends of the second, third and fourth ribs on the painful side. This was verified by x-ray, according to which the pleura and lungs were not involved, and the bone changes not sufficiently characteristic to justify a diagnosis of sarcoma.

As a preliminary measure, antiluetic treatment was instituted. The enlargements gradually disappeared. Five years later the patient's physician reported that she was perfectly well.

It is in these obscure cases that surgical judgment is more to be desired than the most perfected surgical technic.

The most prevalent benign tumors of the human breast are the fibroadenomas. Fibroma and myxoma are rare and occur usually as a differentiation of the fibroadenoma.

Fibroadenomas are mixed tumors and, according to McFarland, constitute about one fourth of the benign tumors of the female breast. They are usually slow-growing, compact and painless. They are firm and elastic to the touch and move about under the examining finger. Pure adenomas of the breast are uncommon. Karsner states that "grossly, except in density of consistency, they resemble fibroadenomas." It is in this group—the fibroadenomas—where, in a woman of cancerous age, the differential diagnosis may mean the difference between life and death for the patient. The examining fingers of the experienced surgeon often may recognize the minute but significant details which reveal the probable nature of the growth.

According to our standard textbooks, fibroadenomas which, may I remind you, constitute one fourth of all benign mammary-gland tumors, are firm, elastic, lobulated and of slow growth. They are unassociated with retracted nipples, glandular enlargements or adhesion to the skin and are rarely painful. They usually occur as single growths. In my twenty-five years of experience as a surgeon, I have found, on many occasions, fibroadenomas which varied widely from the accepted standard of requirements for tumors of this type. In spite of the classical descriptions of the fibroadenoma, I have encountered many associated with retraction (congenital) of the nipple. I have found them accompanied by glandular enlargements of inflammatory nature, of single and of multiple growth. I have examined many adenomas which have been of slow growth and which, upon frozen section, have revealed a beginning malignancy and others which have grown with great rapidity and have proved upon section to be of purely benign pathology. Some have been as small as hazelnuts; others as large as oranges. These contrasts are merely stated to indicate that we dare not make a *final* diagnosis of any breast lesion based alone upon the usual classical description of such a tumor. Clinical experience must be our guide!

The following case from my files is cited to illustrate the possibility of exact diagnosis in spite of lack of classical symptoms, and the conservation of the mammary gland in spite of apparent evidence of malignancy.

CASE 6.—V., female, fifty-four years of age, married. This patient consulted me December, 1910, for a growth about the size of a hen's egg in the outer margin of the left breast. The nipple on this side was retracted. The tumor had been observed for five years and had developed slowly, until a month earlier when it had begun to grow rapidly and had become painful.

In a woman of so-called cancerous age, the presence of a slow-growing tumor, which suddenly increases rapidly in size and is associated with retraction of the nipple, strongly suggests malignancy.

Careful inquiry revealed the retraction of the nipple to be of congenital origin; repeated palpation of the tumor mass failed to evidence the "feel" of malignancy.

Operation was performed and a V-shaped section of the outer portion of the breast, including a mass midway between the areola and the periphery, was removed. This involved about one-eighth of the breast substance. Great care was taken to maintain the continuity of the nipple and ducts with that portion of the breast tissue which was left. The posterior and anterior layers of the capsule were approximated by interrupted catgut stitches.

The pathologic report was "fibroadenoma." The contour of the breast was well preserved, and the scar became practically invisible. There was no recurrence.

In cases of suspected malignancy, wide excision of the growth, with the use of the endothermic knife or the cautery applied to the cut edges, is a safeguard to the patient. Frozen section at the time of operation may be helpful to confirm the diagnosis, but must not be accepted as an infallible guide.

In conclusion, may I again emphasize the variations which make accurate (preoperative) diagnosis, in many breast conditions, a difficult, if not an almost impossible, task? A very apt illustration of this point may be applied from a recent article by Warden Lawes of Sing Sing Prison. The warden wrote: "We approach the problem (of the criminal) with preconceived notions, and should heed the remark of the witty Frenchman who warns us to 'beware of looking for anything, for we shall be sure to find it.' The shape of the skull is frequently made the basis of criminality, and yet in examining the skull of Charlotte Corday, three distinguished authorities reached different conclusions. The personal equation of investigators enters into every investigation."

The deduction of Warden Lawes may be applied to the physical as well as the mental diagnosis. The physician who approaches a pathologic breast with the preconceived idea that a retraction of the nipple is a certain sign of malignancy may find his diagnosis far from correct. There are numerous seemingly pathologic breasts which must be considered in the light of congenital abnormalities, or as processes of evolution or involution of the mammary gland. There are chronic and acute inflammatory conditions expressed as tumefaction of the breast tissue. There are mammary glands which evidence an endocrine dysfunction in the individual, or an alimentary or other toxemia. There are carcinomatous breasts with the signs of benign pathology; there are benign tumors of the gland with many evidences of malignancy—including congenital retraction of the nipple.

Out of all of this mass of contradictory material, indicating the difficulty of exact diagnosis in breast pathology, *how* are we to arrive at a definite conclusion when called upon to diagnose abnormal conditions of the mammary gland? Epictetus said: "If you would be a reader,

read; if a writer, write" and, he might have added, if a diagnostician, diagnose. Experience is the skill or practical wisdom gained by personal knowledge, and it is such skill to which the woman with the abnormal or pathologic breast is entitled when she places her future usefulness in the hands of the surgeon. Every test applicable, clinical and laboratory, should be applied to verify the diagnosis, though it may be in order to sound a note of warning against the habit on the physician's part of shouldering his responsibility upon the laboratory. No laboratory can ever take the place of the experienced physician; his is the responsibility in the last analysis, and he should be ready to accept his responsibility to the full. Each case should have infinite patience and intelligent thought expended upon it. We should realize the individuality of each mammary gland, its past, its potentialities.

Finally, the patient has the right to demand this painstaking effort, this exactness of diagnosis. A criminal is presumed (under the law) to be innocent, until proved guilty. A mammary gland should have the same privilege. A diagnosis must be based upon every available source of relative information. When the most radical surgery is indicated, there should be no hesitation in employing it immediately; in doubtful cases there should be critical investigation and in every non-malignant tumor of the human breast the surgeon should aim toward the preservation and conservation of the mammary gland.

34 GRAMERCY PARK.

Haselhorst, G.: Actinomycosis of the Female Genitalia, Following Criminal Abortion. Arch. f. Gynäk. 134: 561, 1928.

The author reports a case of actinomycosis of the female genitalia with secondary involvement of the entire pelvis and the spine, following instrumental criminal abortion. The original diagnosis was puerperal parametritis. Aspiration of the pus from the posterior culdesac led to the finding of the actinomyces. The patient lived for ten months following the onset of the infection. Postmortem examination showed involvement of all the pelvic connective tissue, the tissues about the left hip joint, and several of the intervertebral discs of the spine, the sacrum, and the symphysis. No foci were found in the peritoneum or in the intestinal tract. Typical granules were found in the left parametrium, but the uterine mucosa and musculature were free. A small fistula was discovered just above the internal os leading through the uterine wall into the left parametrium. This was probably due to the original instrumentation and was unquestionably the entrance port of the infection.

RALPH A. REIS.

A RAPID NONSURGICAL PROCEDURE FOR AIDING CHILDBIRTH

By Nicholas Temesvary, M.D., Budapest, Hungary
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IT HAS long been the ambition of physicians to lessen the pain of childbirth either by total obliteration, or at least by its partial relief, or by acceleration of the period of childbirth.

With regard to the first, I wish only to mention briefly the various narcotic and anesthetic methods. In the cases of ordinary labor, where the period takes hours and sometimes even days, we cannot employ chloroform or ether, because it would require too large quantities of these drugs; and, as they are not harmless, their employment would be dangerous. Therefore, in the cases of ordinary childbirth we would employ only one of these narcotics at the end of the delivery, when the presenting part proceeds through the vulva.

Considering that the pains due to the contractions of the uterus cause suffering throughout the whole period of labor, and at the time of dilatation even in a greater measure than at the expulsion period, other methods should be looked for to relieve these pains. Such is the combination of scopolamine and morphine which produces twilight sleep. This procedure, however, has already been abandoned by most clinicians, as it sometimes produced a state of excitement in the patients, which weakened the contractions of the uterus and thus protracted the labor, necessitating the frequent use of forceps. The babies were in many instances born asphyxiated or dazed. Hypnosis or other psychotherapeutic procedures (hypnonarcotics, suggestion), as they required longer preparation during pregnancy and are not indifferent to the further nerve life, failed also. Trials made with pernocton, narcylen, amnesin, somnifen, avertin and parasacralis injections were also unsatisfactory or did not lead to any definite results. Recently the synergetic narcosis of Gwathmey has been slowly spreading through Europe.

All of these procedures, without mentioning others, have the common disadvantage that the physician has to be present during the entire labor, which is not an unimportant condition in normal, but especially so in protracted labors in private practice.

Discussing next the second method of facilitating labor, which really consists of shortening the period of childbirth, it is necessary to divide the cases into two groups: first, those in which the prolongation of the labor would prove harmful to the mother, including heart diseases, eclampsia, fever, hemorrhage, and premature rupture of membranes.

Here infection may set in more easily, etc. And in the fetus likewise there is danger of asphyxia and death. The second class includes the normal labors where the attempt is made to lessen the pains of the mother by accelerating the delivery. There is a tendency of some obstetricians to resort to cesarean section at the slightest irregularity or deviation from the normal. The statistics even of today are not nearly as favorable after cesarean section as after deliveries *per vias naturales.*

The movement for an increased number of cesarean sections was recently revived by Max Hirsch, in Germany. The propagation of this ill-advised activity, however, had not many followers and at the congress of gynecologists held a few weeks ago in Leipzig, this question was fully discussed and met with considerable opposition on all sides. There is no doubt that in many cases of prolonged labor it considerably influences the morbidity and mortality of the mother as well as of the fetus.

As far as the attempts are concerned to accelerate labor, it is primarily to be observed that they have the special aim of shortening the dilatation period, which is the most painful period of labor.

The acceleration of the dilatation of the cervix and the os uteri can be attained mechanically by the Bossi and Tarnier dilators. However, if force is used in employing these instruments or the dilatation is performed too rapidly, great damage is done by laceration of the cervix and consequent profuse bleeding. These instruments have been removed from the instrument case of most obstetricians. The metreurynters, which are introduced into the uterine cavity, as the Voorhees, Barnes or Braun bags, can only be employed in very special cases, because of the danger of introduction of pathogenic germs.

It is indubitable that at present drugs increasing the contractions enjoy the widest popularity. First of all, we have to mention quinine, which can be given with success, but in small doses it very often remains ineffective, and when given in large doses it may cause disagreeable symptoms.

We may say that the greatest progress in this way has been made through the discovery by Hofbauer of pituitary extract and its effect on the muscles of the uterus. It was found, however, that one has to be very cautious and that the drug can be given only during the expulsion period or at the utmost with a disappearing os uteri, as it often causes tetanic contractions of the uterus, which may be harmful to the mother and the fetus during the dilatation period. Lately, some have tried to give $\frac{1}{5}$ part of the pituitrin dose, and this small dose was repeated 4 or 5 times at half-hour intervals. This method, which was first recommended by Stein, of New York, has the disadvantage that it is very often ineffective and the continuous presence of the physician is required. Very often the first or second dose is effective, while the third or fourth doses are ineffective.

We would call a medicament ideal which would increase numerically the ordinary contractions as well as their intensity. The pains should, however, remain physiologic and rhythmical, and the muscles of the uterus should not become exhausted in spite of the increased work, until the termination of labor. Its effect should extend to the placental stage, and the secondary atony of the uterus after childbirth should not take place, as occurs with pituitrin.

About four years ago in Vienna I reported my experiments at the Congress held by the German Gynecologic Association. Experiments with nearly all the glands of internal secretion were tried on pregnant animals and with surviving organs, according to the well-known Magnus-Kehrer method. From these experiments I found that the thymus extract is most suitable for our purposes. Its effect, it seems, is not a specific one of the thymus gland, and as far as its intensity is concerned, is inferior to pituitrin extract. The latter has a short effect only and, as already mentioned, frequently produces tetanic contractions. On the contrary, the contractions produced by the thymus extract, although not so intense, are more rhythmical and last longer.

From Ascher's Physiological Institute in Berne, important articles have appeared by Mueller and Del Campo. Their results were recently confirmed by Held; namely, that thymus extract possesses another quality, very important for our purposes, a specific by which the time of exhaustion of the not over-fatigued muscle can be delayed, thus acting as a preventative. These observations led me to the conclusion that both glands, the pituitary and the thymus gland, could be employed to cause strong uterine contractions whose effect would last longer.

After prolonged experiment, I succeeded in combining satisfactorily the extracts of the two glands. These experiments have since been confirmed by Graff with the Molidor and Pick procedure, which consists of diuresis experiments in dogs.

I afterwards employed this drug with good results in human labor. At the beginning I was able to report very good success in 150 cases which was followed by another series of new successes. These induced the Chemosan factory in Vienna to put a standardized preparation before the profession, bearing the name of "Thymophysin."

Further observations with this preparation have since grown to more than 1000 cases. My personal observations were made at the All Saints Hospital at Breslau, during the period when I was assistant, and recently at the Budapest Lying-in Hospital as chief of service. Among other clinicians reporting favorably upon the use of this drug are the following: Burghardt of Wurzburg, Jahreiss of Augsburg, Graff, Adler, Keitler, and Aschner of Vienna, Caspary of Dresden, Ostreil of Prague, E. Zweifel of Munich, Haynes of Detroit, and Jarcho of New York.

The effects of thymophysin may be summarized as follows: The drug can be employed where there is no great disproportion between the pelvis and the head and where diseases of the kidneys or heart are not present. The time of employment is chiefly in the dilatation period. During the expulsion period we see results similar to those with pure pituitrin preparations. Some workers, as Lieb, Jarcho, and others, have seen better results in the expulsion period with thymophysin than with pituitrin alone. During the third stage of labor, a large dose of pituitrin gives a better result. The employment of the drug too early in labor, that is, when labor has not yet begun, is not desirable, though no harmful effects even in this stage have been observed. The normal dose of thymophysin appears to have no effect whatever if the uterus is not yet sensitized or the labor has not begun. Thymophysin is also employed for diagnostic purposes to distinguish the so-called false pains from the ordinary pains of childbirth. If a woman is given 1 c.c. of thymophysin and it has no effect, then one can be almost sure that labor has not yet begun, and the patient is not compelled to stay in the hospital for days, though she has false pains. As already mentioned, thymophysin is effective at the beginning of the dilatation period, and we may say that at this period the effect is the best. This effect is the most important one, because as labor progresses the pains become less intense. On the other hand, if thymophysin is given at once, the contractions will appear every two or three minutes, and their intensity will be much greater.

The peculiarities of the effect of the thymus extracts make it desirable that this drug should not be given if the uterus is exhausted, as it will be quite ineffective. In this case if the woman has been in labor for many hours and labor does not progress, the best course would be to rest the uterus with morphine, and only if this is done, may thymophysin be administered.

In normal cases labor usually lasts on the average from sixteen to twenty hours in primiparas, and from ten to twelve hours in multiparas; but sometimes it is extended over a much longer period, even days. However, by employing thymophysin the primiparous labor lasts from three to five hours and the multiparous labor from two to three hours instead of the normal time already mentioned.

Graff, of the Kermauner Clinic, treated 270 patients with thymophysin and found that three hours is the regular time in which birth occurred, and as stated by himself, in many cases the birth occurs in a surprisingly short time. Among the 270 cases there were only 5 in which the labor lasted five hours.

Oliver, of the Vienna Lucina, treated 100 patients with thymophysin; and, according to his experience in the case of primiparas, the average time was three and a half hours and the average time for multiparas was from twenty minutes to two hours.

Gräfenberg, of Berlin, found the whole time of labor in primiparas to be four hours, and in the case of multiparas, only half of this time.

Haynes, of Detroit, who became acquainted with this drug in Europe, reported in the *Michigan State Medical Journal* that in 31 cases the time in which birth occurred was from twenty to one hundred eighty minutes after employing the drug. These numbers prove that the employment of thymophysin, at the right time, considerably shortens the labor.

The employment of thymophysin is not only indicated in those cases where we desire to lessen the pains of the mother in normal cases, but also in pathologic cases when a quick birth is desirable in the interest of the mother and child, or with strong pains only, delivery by the natural passage is impossible. In such cases if, according to Bumm, pituitrin can be called "medicamental forceps," we can certainly call thymophysin a "medicamental dilator." Such indications are premature rupture of membranes, or artificial rupture of the membranes for some cause such as placenta previa, slightly contracted pelvis, elderly primipara, and eclampsia in not too serious cases. We know very well that a premature rupture of the membranes and the consequent protracted labor can have dangerous consequences. On the one hand there is greater possibility of the infection of the mother and this is where the morbidity and mortality of the mother occur; and there is also asphyxiation of the fetus, and intrauterine death following premature rupture of membranes is liable to occur much more frequently. It is, therefore, to be recommended in cases of rupture of the membranes to endeavor to shorten the delivery.

It is further well known that in a slightly contracted pelvis the adjustment of the head depends on the intensity of the pains. Therefore, in these cases there are also indications for employing thymophysin.

With placenta previa I have seen very satisfactory results in 10 cases, naturally only with the marginal type when, after rupturing the membranes, thymophysin was given. In such cases the part lying in front tampons the placenta previa, and the strong labor rapidly enlarges the cervical canal. As far as the mild cases of eclampsia are concerned, it is easily understood that a rapid labor may be life saving. In these cases, even in a preeclampsia stage, pituitrin is contraindicated, because it causes an increase of blood pressure. On the other hand, many physicians have made the observation that after the use of thymus extract the blood pressure decreased. My observations have confirmed the observation that, if we combine the two above mentioned preparations, they neutralize one another and can, therefore, be given in eclampsia cases without hesitation.

Thymophysin is sometimes ineffective. The reasons for this, after disregarding cases where the preparation is incorrectly given, or in too small a dose, or too late, are the following: when labor has not yet begun, when the uterus is too exhausted or too distended (twins or hydramnios), or in consequence of toxic injury to the muscles of the

uterus, or perhaps also in injury to the nervous centers through the infection which at the time is not yet manifest.

The dosage: One cubic centimeter has been found a sufficient initial dose. Only in cases of need, when the effect is not sufficient, or if it ceases before labor is over, a second, or in exceptional cases, a third injection may be given without any harmful effect. The injections must be given intramuscularly, best intragluteal, but never intravenously. The first pains are very strong and so intense, as stated by many physicians, that only those who know the thymophysin dosage do not fear them. In many thousands of cases there has never been observed any harmful effect attributable to thymophysin upon the mother or the child. Thymophysin produces no secondary inertia and the effect lasts over the placental period so that the placenta is generally expelled spontaneously a few minutes after birth without much bleeding.

My experience and that of others in a large series of cases will vouch for the efficiency of thymophysin, both in the cases of normal and of pathologic labors. Since labor is shortened, pain is lessened, and the child is protected from such injuries as may result from a protracted labor. Fatiguing work is made lighter, much time is saved, and the attendant's work is made more agreeable. With this method it is also possible, because the time of the labor is considerably shortened, to employ a harmless, pain-diminishing drug.

Zacherl, H.: Appendicitis in Its Relation to the Female Sex Organs. Wien. klin. Wchnschr. 42: 11, 1929.

Little that is new is offered, and the treatment advocated is along orthodox lines. In pregnancy with appendiceal abscess the author does not favor induction by vaginal section plus drainage by laparotomy, as some writers have suggested, but leans toward laparotomy for the appendiceal abscess alone. He emphasizes early diagnosis and operation when the condition complicates pregnancy.

FRANK SPIELMAN.

Devraigne, L., and Mayer M.: Treatment of Grave Hemorrhages by Means of Intravenous Injections of Citrated Serum. Bull. Soc. d'obst. et de Gynec. 7: 466, 1929.

The authors report 4 cases of severe hemorrhage successfully treated by means of intravenous injection of citrated serum. The beneficial action is due to effects similar to those of normal saline solution and blood transfusion, as was proved in animals. The solution used by the authors contains the citrate of sodium, calcium, magnesium, ammonia, and manganese in addition to distilled water.

J. P. GREENHILL.

POSTOPERATIVE ABDOMINAL AUSCULTATION

By James E. King, M.D., Buffalo, N. Y.

IN 1819 Laënnec published his work on auscultation for the diagnosis of pulmonary disease, and since that time the stethoscope has become indispensable to every practicing physician. Its value and use have broadened, and today we find it an aid to the diagnosis of many other conditions besides that for which it was first proposed. Its use in abdominal diagnosis, however, has found small place in medicine and still less in surgery. The chief reason for this lies in the fact that peristaltic sounds, even under normal conditions, vary greatly with the intake of food and the stage of digestion. It is therefore impossible to define exactly the sounds associated with normal intestinal movement. It is also impossible to determine by its character the particular point of origin of the peristaltic contraction, although one may differentiate between small intestine and colon. In the light of our present knowledge abdominal auscultation can distinguish only two conditions, the absence of peristalsis, or its abnormal activity.

The x-ray plate, the fluoroscope, and the moving picture have destroyed many cherished views regarding intestinal activity. They have shown that an enema administered through the colon tube is no different in effect than an enema through the rectal tip. They have taught us much else of value concerning the behavior of the digestive tract in health and disease. Perhaps in the future some patient worker may be able to correlate those known intestinal movements with the sounds produced. There are also great possibilities for the painstaking clinician who will study intestinal sounds in connection with the clinical manifestations of abdominal disease. For the present, however, the value of abdominal auscultation is confined almost entirely to the province of the abdominal surgeon.

A large number of abdominal operations are associated with some postoperative disturbance of intestinal peristalsis, either as a result of perverted nerve impulses or as a direct effect of a complication. To him who becomes familiar with the postoperative behavior of the intestines as revealed by auscultation, the stethoscope will contribute much to a better understanding of these clinical conditions, and it will sometimes render valuable aid in the early diagnosis of certain postoperative complications.

The most common intestinal disturbance following laparotomy is the so-called "gas pains." Under this term the surgeon is content to classify most of the postoperative abdominal pain and discomfort. There has been much written in explanation of this troublesome con-

dition. Two outstanding clinical features are that it appears from twenty-four to seventy-two hours after operation, and that the type of operative procedure seems to have little to do with its occurrence or severity. A comparatively simple operation for retroversion may be followed by marked intestinal disturbance, while one involving separation of extensive intestinal adhesions may pursue a placid postoperative course. It is not within the province of this paper to discuss at length the causes; suffice it to say that in the large majority of instances "gas pains" may be regarded as a disturbance of normal motility of the intestine arising from a perversion of the innervation. The clinical types that are encountered are difficult to classify, for they present varying degrees of distention and pain, sometimes associated with equally varying degrees of nausea and vomiting; and the many possible combinations offer great variation in the clinical picture. If, however, one will approach such postoperative manifestations as being possibly due to disturbed intestinal innervation, the stethoscope will afford a basis for classifying these cases within certain limits.

The postoperative disturbed nerve impulses may be regarded as producing in the intestinal tract three results: inhibition, overstimulation, and reverse peristalsis. The question as to whether these states are produced reflexly, as a result of the abdominal incision, or whether they follow manipulation of the intestines and originate in the sympathetic system will not be discussed here. It may also be urged that the anodyne required after most abdominal operations is a large factor in producing the intestinal disturbance. That it has some influence may be granted, although in patients where anodynes have not been given gas pains sometimes occur. In a practical clinical approach to the subject, however, it makes little difference whether anodynes are or are not a factor, as relief of pain caused by the operation itself must be afforded.

The course of events in the majority of laparotomies is as follows: For a variable period auscultation shows a much diminished peristalsis. Peristalsis increases during the next twenty-four to forty-eight hours, and the pain associated with it bears a relation to the severity of the contractions. A cathartic and enema at this stage result in expulsion of gas and a bowel movement, following which normal peristaltic action is apparently reestablished. The first stage may be regarded as the stage of inhibition, the second as one of spastic contraction. The difference in intensity and duration of these two stages, often with the addition of distention and vomiting, gives the variation in the clinical picture. With distention that appears early after operation, there is practically always associated a marked decrease in peristalsis. An occasional gentle peristaltic wave is heard, but colon peristalsis is absent and no flatus is passed. If an enema be

given during this stage of inhibition, it is not successful and usually has to be syphoned back. As soon as colon gurgling appears, however, an enema may be given with confidence that it will be successful. Until this occurs efforts to relieve the distention will be of little avail. If, in such a case, vomiting adds to the discomfort of the patient, it will be found as a rule to be the result of duodenal regurgitation, as evidenced by the character of the material vomited. I have never been able to distinguish any characteristic sounds associated with this type of vomiting. Whether it is due to a true reverse peristalsis or merely to a seeping back of duodenal contents through a relaxed pylorus, is difficult to decide. The use of the stethoscope in such postoperative states of course is not essential to the safety of the patient, but it does give to the surgeon a certain confidence and satisfaction in the thought that he has some knowledge of what is transpiring in the abdomen and suggests a rational plan of treatment. The degree of inhibition varies up to the point of what might be regarded as true paresis, a condition which will be discussed later.

The spastic stage following the stage of inhibition produces the pain we designate as "gas pains." The term is appealing, although not entirely accurate, as frequently severe pain of this stage is not associated with distention. On the other hand, however, the degree of distention often bears a relation to the severity of the pain. The stethoscope during this stage shows marked peristalsis of the sudden forceful type. There may be continuous pain with exacerbations cramp-like in character, coinciding with the peristaltic sounds. They may be heard all over the abdomen, although occasionally they seem to be confined to certain areas. In some instances it has seemed that the cause of these forceful contractions was due to the fact that stimulation returned first to certain segments only, and that a part of the tube was still under the influence of inhibition. Another occasional manifestation of this stage is a constant pain in the midline above the umbilicus, referred through to the back. It comes on rather suddenly and may last for several hours. The patients describe it as a continuous griping cramp, and auscultation does not show the usual forceful peristalsis. Possibly here we have a spasmodic contraction of the duodenum.

We may now pass to a consideration of the more serious postoperative abdominal complications. The most important and frequent are peritonitis and obstruction, and for a third may be added intestinal paresis, or paralytic ileus, known to the laity as "paralysis of the bowels." In a consideration of these conditions in connection with the value of auscultation, no attempt is made to discuss the well-known clinical aspects. It is obvious, however, that the stethoscope is of value only when the auscultatory findings are appraised in their relation to the clinical evidence.

The classification of peritonitis by the older surgeons into plastic and septic is not a strictly accurate one, for the plastic peritonitis is associated with sepsis, and the septic is associated with plastic adhesions. As a clinical grouping it is convenient, as it implies in the one the action of the less virulent bacteria, such as the colon bacillus, and in the other invasion by the more virulent streptococcus. Perhaps the most typical illustration of the use of the stethoscope in peritonitis is found in the ruptured appendiceal abscess. Naturally, the diagnosis of ruptured abscess is almost never in doubt, as the physical findings and clinical evidence are sufficient for the surgeon of experience. It is interesting to observe, however, how promptly the inhibition of peristalsis appears. Almost directly there is a marked decrease in intestinal movements. There may be heard at intervals a gentle, quickly subsiding movement, as though an isolated intestinal coil were making a feeble attempt to resist the inhibition placed upon it. Usually, however, by the time the patient is seen by the surgeon, peristalsis has ceased. Following the operation the distention increases and no peristaltic sounds are heard, and the silence may be disturbed only by the boom of the heart clearly transmitted. Our house surgeons like to characterize this as the "graveyard belly," a term which unfortunately may have a double significance. This state of affairs persists for three days, four days, or perhaps a week, and then one day a gentle sound is heard and after an interval another, which relieves uncertainty. It is a welcome sound. At this stage the opium is decreased, for it is assumed that the Alonzo Clark treatment has been employed. During the next twenty-four hours peristalsis has become more general, a small enema may bring gas, and the patient may be considered then as entering the stage of convalescence. The inexperienced surgeon has great difficulty in leaving these patients alone. If vomiting is a marked feature, and the distention is great, instead of employing the stomach tube and opium, he adds distress and increased danger to the patient by the use of cathartics and various enemas. He may seek to relieve the distention by pituitrin or may even consider intestinal drainage. Every surgeon of experience has been asked to see such cases, and to pass upon the advisability of drainage on the assumption of obstructed bowel. The stethoscope under these circumstances is a great comfort, and makes it possible to take a firm stand on diagnosis and treatment, and helps in determining the prognosis.

A plastic peritonitis that follows an operative procedure is first indicated also by the absence of peristalsis. In cases where from the nature of the operation peritonitis may be anticipated, it is found that peristalsis disappears in from twelve to twenty-four hours. After this, the course is similar to that as outlined above.

The septic form of peritonitis will give early the same evidence on

auscultation as the plastic type. Naturally, one will not be able, by the stethoscope, to differentiate between the plastic and septic forms. I have sometimes noted early in the septic form a continuous, gentle peristalsis heard all over the abdomen as though the entire intestine were in a state of gentle purposeless movement. This, however, is transient and is followed by a complete absence of peristalsis. The greater virulence of the septic peritonitis is indicated by the clinical picture and death occurs without peristalsis being reestablished. In these cases the stethoscope offers nothing of value except its aid in early diagnosis.

Postoperative obstruction of the bowel is dreaded by every surgeon. Its early recognition is essential for successful treatment. The diagnostic criteria furnished by the average textbook are often those of an advanced stage. Vomiting and cramp-like pain are the two clinical indications of the greatest importance. Postoperative vomiting that persists after twenty-four hours, or vomiting that begins two or three days after operation, calls for careful analysis in its relation to the general clinical picture, together with the evidence obtained by abdominal auscultation.

Obstruction following pelvic surgery, in the majority of instances, has its origin in the small bowel, the last two feet of the ileum being the most frequent location. By far the greatest number of these obstructions will be found as angulations due to an intestinal loop becoming adherent to a denuded surface or line of suture. Such a case should present little difficulty in early diagnosis. Vomiting begins promptly if the obstruction has occurred directly after operation, but during the period of usual postoperative peristaltic inhibition it may be infrequent. At the end of forty-eight hours vomiting increases in frequency, and is accompanied by peristaltic pain. Auscultation at this time gives evidence of forceful intestinal contraction, distention progresses, and the vomited material consists of duodenal contents. The question now is, whether one is dealing with an obstruction, or an aggravated case of spastic peristalsis. The stethoscope demonstrates active peristalsis, and one is justified in expecting, if the case is not one of obstruction, that an enema will bring gas. If repeated effort in this direction fails and if at the same time there is increasingly violent peristalsis, a diagnosis of obstruction is justified. In my own series of cases this diagnostic criterion has been most reliable, and I have come to depend more and more upon auscultation in establishing an early diagnosis. One must remember, however, that with the higher obstructions the first enema or two may bring away some flatus that lies below the obstruction. This should not be misleading, for if auscultation shows violent peristalsis we have reason to expect very soon a corresponding satisfactory response from the colon. There is a great difference in the interval between the painful peristaltic con-

tractions. Early they may be rather infrequent, increasing in frequency as the condition progresses. Later, when distention is marked, there comes a time when the edematous bowel can no longer contract so completely; and one hears the tinkle and gurgle of shifting fluid and gas in the distended bowel. As the end draws near, the migration of bacteria and absorption of toxins may abolish peristalsis and the patient dies, the picture of peritonitis.

In the less common types of obstruction, auscultation is also of great advantage. One sees occasionally instances in which the bowel is obstructed perhaps in two places with several feet between the two points of obstruction. Or it may happen that following operation a considerable portion of collapsed bowel has prolapsed into the pelvis and become adherent. In these circumstances there may be very moderate distention, and peristalsis becomes more or less localized. This has been noted a number of times.

Perhaps one of the greatest values of the stethoscope is in the early differentiation between obstruction and peritonitis. I have never known it to lead one astray if the evidence obtained by auscultation has been carefully considered in connection with the clinical evidence.

Whether or not the so-called postoperative paralytic ileus should occupy a place as a surgical complication is difficult to decide. The possibility of its occurrence, theoretically at least, cannot be denied, as a somewhat comparable condition is seen in acute dilatation of the stomach. It must be extremely rare, although one hears not infrequently of a postoperative death due to this cause. A death from "paralysis of the bowels," however, is attended by far less embarrassment to the surgeon than a death from peritonitis. It is a diagnosis that apparently has been handed down from the early days of abdominal surgery when peritonitis was far more common and far less understood. If such a condition does exist, certain it is that there is no well-defined clinical data that establishes a diagnosis. Whether auscultation offers any aid is a question that cannot be answered. Extreme postoperative inhibition continuing for several days with great distention, vomiting, absence of peristalsis, where cathartics and enemas are futile, presents a clinical picture that suggests the propriety of regarding it as a paralytic condition of the bowel. If one wishes to regard it as such, there can be no quarrel. If, however, one has studied by auscultation a series of patients showing operative intestinal disturbance, he is convinced that in these extreme instances he is not dealing with a difference in kind but one of degree.

Like all specialized procedures in diagnosis, abdominal auscultation requires study and personal observation. The results are obviously not as definite and convincing as those obtained in pulmonary and cardiac disease. No attempt here has been made to describe the sounds

produced by peristalsis. They are too varied. A large number of patients following operation will show no deviation from normal. In the study, however, of patients showing disturbance the stethoscope will reveal much of interest and value. I believe that we should eliminate the term "gas pains" from our discussions and leave it, together with "paralysis of the bowels," to those members of the laity who find it desirable to embellish the recital of their surgical experience.

1255 Delaware Avenue.

SARCOMA OF THE VAGINA

By Stephen E. Tracy, M.D., F.A.C.S., Philadelphia, Pa.

SARCOMA of the vagina is fortunately a rare disease. In 1911 McFarland could collect from the literature only 101 cases which, with the one he added, made a total of 102 cases up to that date. He stated that there were only 68 cases of sarcoma of the vagina (not including sarcoma botryoides) reported in forty-two years. In his collection he found only one case which was congenital and one case which came to operation when the patient was eighty-two years of age.

Williams tabulated a consecutive series of 9,226 tumors found in women. Of these 2,648 were of uterine origin, and only 54 tumors arose from the vagina. Of the 54 vaginal neoplasms only two were sarcomas.

Lynch reported that there had been only one case of sarcoma botryoides in his clinic at the University of California among the last 4,000 gynecologic cases.

A large percentage of sarcoma of the vagina is found in childhood as sarcoma botryoides, the first case of which seems to have been reported by Gersant in 1854.

It is claimed that sarcoma of the vagina in children develops from misplaced embryonal mesodermic cells and that it is a mixed tumor; while in adults the lesion results from metaplasia of connective tissue cells. For these reasons and because of the different clinical picture, sarcoma of the vagina is classified as that which is found in children, and that which develops in adults.

In sarcoma of childhood it is possible that the growth may be present at birth but is overlooked. It is usually stated that the majority of lesions develop during the first year. McFarland's statistics disprove this idea. In a careful review of the literature he tabulated 44 cases of sarcoma of the vagina; 34 of which were sarcoma botryoides present in children within the first five years of age, and ten of which were

sarcomas of miscellaneous types found in children between the ages of eight months and thirty-one months.

The age incidence in sarcoma of the vagina in children was as follows:

	BOTRYOIDES	MISCELLANEOUS	TOTAL	PERCENTAGE
1st year	9	3	12	27.2
2nd year	8	6	14	31.8
3rd year	11	1	12	27.2
4th year	4	0	4	9.1
5th year	2	0	2	4.5
	34	10	44	99.8

These figures show that only 27.2 per cent of the cases developed during the first year of life. The greatest percentage 31.8 developed during the second year of life. During the first three years of life there was found 86.2 per cent of the cases.

The location of the 34 cases of sarcoma botryoides as tabulated by McFarland was as follows:

Anterior vaginal wall	10
Posterior vaginal wall	4
Left vaginal wall	4
Right vaginal wall	2
Vulvovaginal entrance	2
Whole vaginal	2
Not stated	10
	34

In the series of cases of sarcoma of the vagina in children collected by McFarland, all types of histologic pictures were presented.

The first symptom of vaginal sarcoma in children is usually a bloody discharge. Occasionally a polypus protruding from the vulva first calls attention to the lesion. Pain follows rapidly. As the growth fills the pelvis, there is pressure on the bladder, and later cystitis develops, while pressure on the rectum may interfere with defecation.

A review of the literature makes it evident that surgery is of no benefit. After removal the tumor recurs rapidly; the pelvis becomes filled with the growth, and the patient dies from exhaustion or toxemia.

Sarcoma of the vagina in adults like that in children is also rare. McFarland could collect only 58 cases. Vaginal sarcoma in the adult is of two types—the mucosal and the parietal.

The mucosal type presents itself as a mass of soft growth projecting from the infiltrated mucosa, or as a circumscribed tumor.

The parietal variety is more common and usually develops as a well-defined tumor only slightly movable. Occasionally this type develops as a dense nodular infiltration.

McFarland's table of the age incidence of sarcoma of the vagina including 10 cases of miscellaneous sarcoma of the vagina in infancy, but not sarcoma botryoides, was as follows:

	MISCELLANEOUS
First decade	10
Second decade	9
Third decade	5
Fourth decade	16
Fifth decade	5
Sixth decade	9
Seventh decade	1
Eighth decade	1
Ninth decade	1
	57
"Young woman"	1
"Old maid"	1
Age not given	9
	68
Botryoides	34
Total cases	102

These figures show that the tumors are found most frequently in the first, second, fourth and sixth decades of life, with the largest percentage in the fourth decade. The tumor may develop in any part of the vagina but is usually located in the lower portion of the canal.

The location as shown by McFarland's table, including 10 cases of miscellaneous types in children, was as follows:

Vulvovaginal entrance	2
Entire circumference of vagina	2
Anterior wall	20
Posterior wall	19
Right wall	12
Left wall	4
Vesicovaginal septum	1
Rectovaginal septum	1
Not stated	17
	78

We have had under observation four additional cases of sarcoma of the vagina. Two were in the right side of the vagina, one on the anterior wall and one on the right side of the vulvovaginal region. Of these four tumors, two were round cell, one was a spindle cell, and the fourth was of the mixed cell type.

The first case was that of Mrs. E. E., age fifty-five years mother of seven children, who came under observation September 5, 1910. She had had a tumor removed from the vagina more than a year before. At the time of examination she had a mass filling the right side of the vagina and pelvis. On September 12, 1910, the tumor was removed and was found to be a round cell sarcoma. The patient died May 10, 1911, having survived two and one-half years after the tumor was first discovered.

The second case, Miss A. B., age thirty-two years, came under observation in 1911. She had a mass 3 cm. in diameter located in the vesicovaginal septum. The tumor was removed and was found to be a round cell sarcoma. The result in this case is unknown, as the patient disappeared from our observation two and one-half months after leaving the hospital. It is reasonable to suppose that she developed a recurrence, with early death.

The third case is that of Miss S. B., age thirty-five years, a stenographer, who came under observation September 20, 1922. Menstruation began at thirteen years of age, was of the twenty-eight day type, and of seven days' duration. Periods were regular until two years before, when she had amenorrhea for three months. The last month she menstruated twice, periods of five and six days respectively. Menstruation had always been accompanied by severe headaches and were preceded by pain which became less as the period developed. There had also been considerable leucorrhea the last four years.

The last year she suffered with pain in the pelvis and lower abdomen, especially on the left side. At times there had been a burning pain about the rectum, backache and pain in the right leg. The bowels were constipated, and micturition was frequent. The symptoms became gradually more marked, and in April it was necessary for her to resign from her position.

Examination of the abdomen was negative. Pelvic examination revealed a mass in the right side of the vagina. The tumor was semisolid, slightly movable and extended from 2 cm. within the vulva to nearly the vault of the vagina, filled the space between the rectum and side of the pelvis, and pushed up the posterior vaginal wall. The cervix, uterus and appendages were normal. A provisional diagnosis was made of sarcoma, and the removal of the tumor was recommended.

Patient was admitted to the Stetson Hospital on September 23, 1922. Examination of the blood was as follows:

Hemoglobin 85 per cent, erythrocytes 4,480,000, leucocytes 9,100. Polymorphonuclear leucocytes 74 per cent, small lymphocytes 18 per cent, large lymphocytes 8 per cent.

Phenolsulphonephthalein output for two hours was 42 per cent. The urine was negative with the exception of a few epithelial cells.

On September 25, under gas anesthesia, the perineum was divided, and the mass was enucleated. Bleeding was profuse and could be controlled only by packing the tumor cavity with gauze. The perineum was then sutured and the vagina packed tightly with gauze. The following day the vaginal gauze was removed, and all the gauze from the tumor cavity was out by September 30. The wound was healed and the patient was discharged from the hospital October 13, 1922.

The pathologist reported the tumor to be a degenerated fibroma with several fair-sized cysts throughout the specimen. A number of other pathologists agreed with the histologic report.

The patient was seen again on December 18, 1922, at which time she looked well and stated she was much improved and had resumed her occupation. Examination showed the pelvic organs to be normal with the exception of some thickening of the vaginal wall in the region of the wound.

She reported again on June 6, 1923; at which time she complained of headache, pain in the pelvis, lower abdomen and right leg. Pelvic examination revealed a growth in the right side of the vagina about 50 per cent larger than the original tumor. A clinical diagnosis was again made of sarcoma, and operation was recommended.

The patient was admitted to the hospital on June 23, 1923. Examination showed the blood, urine and renal function to be normal. The Wassermann test was negative.

On June 25, under gas anesthesia, the perineum was divided in the middle line, and the tumor was enucleated. The hemorrhage was again profuse, and could be controlled only by packing the cavity with gauze which was brought out at the lower end of the incision. The split perineum was sutured, and the vagina packed tightly with gauze. The gauze packing was removed gradually and was all out at the end of the fourth day.

The pathologist now reported the specimen to be a spindle cell sarcoma. The slides were examined by several pathologists, who concurred in the diagnosis.

On July 16, blood examination showed the hemoglobin to be 58 per cent, erythrocytes 3,020,000, leucocytes 7,100. Polymorphonuclear leucocytes 72 per cent, small lymphocytes 19 per cent, large lymphocytes 8 per cent, eosinophiles 1 per cent. On this date under nitrous oxide oxygen anesthesia, the center of the incision over the tumor cavity was opened, and 100 mg. of radium were implanted deep into the cavity and allowed to remain twenty-four hours.

The patient vomited several times while the radium was in place, and complained of pain in the pelvis and of a burning sensation in the bladder.

On July 18, the blood showed the hemoglobin 54 per cent, erythrocytes 3,000,000, leucocytes 10,200, polymorphonuclears 82 per cent, small lymphocytes 14 per cent, large lymphocytes 3 per cent, eosinophiles 1 per cent.

The nausea persisted for three days. The temperature on July 17 at 6 P.M. was 102 degrees F. Two days after the application of radium the patient developed a mild bilateral parotitis, which cleared up in a few days. The discomfort in the bladder continued, and a week later there was considerable pain in the rectum during evacuation.

On July 20, blood examination was as follows: hemoglobin 50 per cent, erythrocytes 2,840,000, leucocytes 6,000, polymorphonuclears 72 per cent, small lymphocytes 19 per cent, large lymphocytes 8 per cent, eosinophiles 1 per cent.

The patient left the hospital on July 29, weak and anemic. She had considerable pain in the pelvis and was compelled to remain in bed for nine months.

When seen at her home on September 24, 1923, she complained of severe pain in the right side of the pelvis and of marked discomfort in the bladder. Examination showed distinct infiltration in the right side of the vagina.

Two months after leaving the hospital she developed a rectovaginal fistula, with pain in the pelvis so severe that it was relieved only by opiates. The pain in the pelvis and the distress in the bladder continued, and she was given morphine freely all winter. The rectovaginal fistula persisted for six months. After it closed, the suffering became less, and the narcotics were gradually withdrawn. In the spring the patient was able to be out of bed, improved rapidly and gained seventy pounds in weight. When seen in May, 1924, she was much improved but complained of marked discomfort in the pelvis, burning and frequent micturition, and severe pain on defecation.

She was admitted to the hospital on June 4, 1924, and under gas anesthesia a vaginal examination showed decidedly less induration in the tissues on the right side of the pelvis. Rectal examination showed the lumen of the bowel to be somewhat constricted from the scar tissue. As a result of the examination the fistula opened and discharged for two months.

Eighteen months after the application of radium, menstruation reappeared and lasted for five days. Since then she has menstruated a few times irregularly, the last period being in September, 1927.

In September, 1925, she came to the hospital complaining of a discomfort in the right side of the pelvis. Examination showed scar tissue at the site of the former tumor. There was no evidence of any recurrence of the sarcoma. Mild x-ray treatments were given with the hope that the discomfort in the pelvis would be relieved.

Because the x-ray treatments appeared to give relief, she received nine during the year and has since been more comfortable.

When seen on September 5, 1929, over six years after the second operation and the application of radium, and seven years after she had come under observation, there was no evidence of recurrence. The patient was fat and the picture of health but had considerable discomfort in the right side of the pelvis.

The fourth patient, Mrs. M. M., age thirty-seven years, has been under observation since October 3, 1927. She had a hard mass about 6 cm. by 4 cm. situated at the right vulvovaginal margin. The tumor was removed October 5, and histologic examination showed it to be a mixed cell sarcoma. Patient was given 1500 mg. hours of radium on October 17, and this was followed by deep x-ray therapy.

Nine months later (July, 1928), a small nodule about 2 cm. in diameter developed. This was removed with the cautery, and 600 mg. hours of radium were given. The area healed rapidly.

In October, 1928, the patient returned to the hospital, and examination showed a nodule about 1 cm. in diameter at the upper end of the scar. This growth was dissected out, and 150 mg. hours of radium were given over this small area. A few weeks later she was given deep x-ray therapy, and following this there was an active recurrence.

In April, 1929, patient returned again. Examination showed a necrotic area about 3 cm. in diameter which had not healed. She was then given a 2400 mg. hours' treatment of radium, which had but little effect on the growth. Since then the disease has been progressive, and the outlook is most unfavorable.

The clinical course of sarcoma of the vagina in the adult as in infants offers a poor prognosis. The tumor tends to rapid recurrence with infiltration of the bladder and a fatal termination through interference with the renal function and toxemia. In these cases metastasis is very rare.

Sarcoma which arises from the rectovaginal and vesicovaginal septae has a tendency to invade the deeper tissues, to fill up the pelvis and to give metastasis to the pelvic and abdominal lymphatics. Cases have been reported of metastasis to the lungs, pleura, ribs and axillary glands. These tumors do not confine themselves to the vagina and bladder.

In Williams' list of cases the longest duration of life from the date of the first symptom was twenty-four months, and the shortest, one and one-half months. Speigelberg had a case of spindle cell fibrosarcoma living at the end of four years. Morris had a patient alive two and one-half years, and Menzel had a patient living at the end of ten months.

Surgery in the treatment of sarcoma of the vagina has been almost a complete failure, as recurrence has taken place promptly, and the ultimate result has been death.

The cure in our third case, that of Miss S. B., if we may term a six-year period a cure, would seem to be due to the use of radium. Surgery in this case was a complete failure, as there was a prompt recurrence after the first operation.

While sarcoma in all parts of the body is usually a rapid and fatal lesion, nevertheless with surgery and irradiation, it would seem that

some cases may be cured. A series of x-ray treatments a short time after the application of radium is of doubtful value. If the malignant process has been checked by the application of radium, additional treatment by x-ray should not be instituted, as it may light up the lesion as in the fourth case, which we now have under observation.

REFERENCES

McFarland, Joseph: Am. J. M. Sc., new series, p. 545, May, 1911. *Williams, W. R.:* Vaginal Tumors With Special Reference to Cancer and Sarcoma, London, 1904, Bale. *Lynch, Frank W.:* Pelvic Neoplasms, New York, 1922, pp. 57 to 67, D. Appleton & Co. *Spiegelberg:* Arch. f. Gynäk. 4: 348, 1872. *Tracy, Stephen E.:* Am. J. Obst. & Dis. Women and Child. 66: 647, 1912. *Morris, A. C.:* Practitioner 2: 593, 1898. *Menzel:* Zentralbl. f. Gynäk., 1895.

1737 CHESTNUT STREET.

METASTASIS OF OVARIAN CARCINOMA

BY M. A. TATE, M.D., CINCINNATI, OHIO

IT IS genenally believed that ovarian cancers are secondary to cancer of one of the organs within the abdominal cavity or the breast, but we do not know the method of transmission. It would be difficult to find a more important subject for pathologists to take up for serious study, as we are at loss in many of our cases to say just where the primary growth had its beginning.

The lymph channels have been credited as the carriers, and are spoken of as the transporters, yet we cannot omit the influence of gravity and peristalsis without saying that they may be decisive adjuncts to carrying implants to ovarian stroma.

When Sampson brought forth his theory of retrograde carriage during the menstrual period and implantation, he gave us a partially credited explanation for some of the cysts of the chocolate variety formation, but we are still ignorant when neighboring organs are involved in a cancerous mass as to which was the primary seat. Did it begin in the uterus, tubes, or in the ovaries?

Pfannenstiel sums up his deductions as follows: "If the ovarian cancer be associated with a similar type in some distant organ, the ovary is usually secondary, but if it be associated with cancer in adjacent organs, as of tubes or uterus, it is probably of primary origin." (Graves.)

The fallacy of reporting a cure in the case of a simple uncomplicated ovariotomy where no pathologic report was made is demonstrated time and again by a follow-up of the case history. Some of these may be read as follows: patient's recovery apparently uneventful. A few weeks or months after her return home she was seized with violent intestinal cramps—diagnosis, intestinal obstruction. At

operation, or later at autopsy, an overlooked cancerous growth was found, which proved to be the seat of obstruction. The object lesson is that all ovarian growths should be carefully examined and no cure pronounced until pathologist's negative report is received.

The literature abounds with so many case reports that there is no question as to the ovary being prone to secondary cancerous deposits, not only from adjacent organs within the pelvis, but from the thyroid, breast, gall bladder, stomach, and intestinal canal.

Novak says, "It is a striking exception to the old time dictum of Virchow that an organ which is prone to primary cancer is rarely the seat of a metastatic cancer. When uterine cancer or ovarian cancer coexist, either organ may be the primary seat of the disease, or in rare cases it is possible that the two cancers may arise independently of one another. In the pelvis, it is now stated, cancer may extend from the uterus to the ovary by the lymph stream, blood stream, implantation through the tube, and by direct contact." Which of the two, the uterus or ovary, is the primary seat is purely guesswork. Implantation, however, is given little credence by many at the present time.

Sampson offers an explanation of the infrequency of ovarian metastasis as due chiefly to the fact that the great majority of cases of adenocarcinoma of the uterus occur in women well beyond the menopause.

As we know so little of the origin of cancerous tissue, it is natural that we have only theoretical explanations of the coexistence of cancerous tumors which are situated in organs remote from each other, as of the stomach and ovary, or breast and ovary. We have, however, come to know and appreciate this important fact, that if a woman have a cancer of an abdominal organ, or of the breast, no operation should be advised without first determining by a pelvic examination that a coexisting mass does not exist in uterus or ovary. The following case presents some unique findings, the like of which I do not find in my search of the literature.

Dr. Larkin, of Hillsboro, Ohio, asked me to see a patient who had been ill for about a year. She had a very large indefinite mass in the left side of the abdomen (right side free) which seemed to be gradually extending to the median line. His diagnosis was that of malignancy, but what organ was involved was problematical. My first impression was that we were dealing with an enlarged spleen. Patient was sent to Deaconess Hospital, Cincinnati, Ohio, for study and treatment. Age fifty-four years; single; occupation, school-teacher. She had had no sickness other than children's diseases, and one mild attack of influenza some four years ago. Slight build, weight 104 pounds, five feet in height, and color pale. Appetite poor, constipated; menstruation had ceased at age of forty-six. At no time since cessation of menstruation was there any vaginal discharge, nor did she complain of pain.

No history of trauma, and family history free from carcinoma or tuberculosis. She noticed some four months previously that the abdomen seemed to be slightly enlarged; and as this increased, she consulted her physician. At no time did she suffer acute pain; but as the enlargement of the abdomen increased, she com-

plained of a heaviness and a tightness of the abdominal walls. She was up and around attending to household duties until one month before I saw her, and even then she was not bedfast. Her chief complaint was indigestion and gaseous distention.

General physical examination was negative. The abdomen was markedly distended, contained much fluid, and a mass was felt on the left side extending from the ribs to the crest of ilium, extending to within one inch of the median abdominal line. Mass on palpation was even and smooth, and could be slightly moved with the abdominal walls. A marked indentation felt about the center of the anterior edge which corresponded to splenic notch seemed a little more pronounced with patient on her right side. No pain was elicited either on palpation or percussion. The doctor informed me that some months previously he had detected some masses along the descending colon which spread rapidly and coalesced into this one large mass. Rectal examination elicited no pain, body of uterus or mass could not be felt, but cervix was small and negative. The legs were not swollen. Wassermann test was negative.

Red Count		*White Count*	
Red corpuscles, per c.mm.,	3,944,000	Leucocytes, per c.mm.,	4000
Hemoglobin	70 per cent	Differential count (percentage):	
Color index	0.84	Polymorphonuclears	76.0
Poikilocytes	None	Small lymphocytes	17.0
Microcytes	None	Large lymphocytes	2.5
Macrocytes	None		
Nucleated red cells:			
Normoblasts	None		
Megaloblasts	None	Eosinophiles	2.0
Achromia	None		
Bacteria	None	Transitionals	2.0
Parasites	None		
Platelets	Normal	Basophiles	0.5
Stipple cells	None	Myelocytes	None
Reticulated reds	None	Irritation forms	None

Laboratory Diagnosis.—Marked secondary anemia with leucopenia and relative polymorphonuclear leucocytosis.

The x-ray examination of the stomach, made fluoroscopically and with film, showed it to be normal; the duodenum was normal. The thirteen hour p.c. examination showed very marked delay, however, in the emptying time of the stomach, and very slow progress of the opaque meal through the distal portion of the small intestine. At the twenty-four hour examination there was again shown some barium in the distal portion of the small intestine. A barium enema given under fluoroscopic observation showed the entire colon to fill without evidence of obstruction or deformity as far as the cecum.

The simple examination of the abdomen with the Bucky film showed no direct evidence of tumor mass, but at no time showed a definite outline of either kidney. I felt that this latter might be due to the accumulation of some fluid, or free fluid in the peritoneal cavity, as the film showed the general hazy appearance associated with fluid in the peritoneal cavity.

We were unable to demonstrate any obstruction, and the slowness of the passage of the meal through the small intestine might have been due to secondary adhesions, or to the presence of fluid and the distention in the abdomen, causing a marked lessening of the peristaltic activity.

The palpable hardness in the left side of the abdomen, if present, or adhesions, if present, were also not shown on the film, though they might be tuberculous in type. The lower dorsal, lumbar spine, and pelvic bones appeared normal.

After repeated examinations, Drs. Larkin and Bettman, and I decided that an exploratory incision was justifiable. The provisional diagnosis was a malignant process of uncertain origin.

A median incision was followed by the escape of three gallons of straw-colored fluid. The extensive growth proved to be an involvement of parietal peritoneum, which extended from the sternum and ribs down the median line of the abdomen to the crest of the ilium, then back to the spine. The right parietal peritoneum was not involved. On the anterior surface just below the umbilicus, a marked indentation was noted, which on first examination I thought might be the splenic notch. This mass extended entirely over the left kidney and splenic regions. The stomach, gall bladder, liver, kidneys, spleen, and upper intestines appeared to be free of any growth or enlargement. The intestines, however, below the umbilicus were studded with numerous small growths, from the size of a pinhead to that of a small pea, and were not unlike miliary tubercles.

In the upper false pelvis a conglomerated mass (size of an orange) was seen, which proved to be the ovaries, tubes, and uterus. Numerous firm bands extended from this mass to the peritoneum, intestines, and pelvis. A section was taken from the involved peritoneal growth. The mass in the pelvis was not disturbed, and we did not look for the appendix.

The abdomen was closed by through-and-through silkworm-gut sutures, and a small drainage tube was inserted into the lower angle of the incision.

Laboratory Report.—Specimen was taken from peritoneum of abdominal wall. Frozen sections revealed large spaces lined by one layer of cuboidal epithelium, which in some places was becoming markedly hyperplastic, with ragged basement and invasion of surrounding tissue. Mitotic figures were numerous and well formed. There was a very dense cellular stroma, somewhat suggesting that found in the submucosa of smooth muscle, but it was mostly fibroblastic tissue. The large size of the epithelial lined spaces suggested a possible mucinous or colloid content, which, however, was absent in the frozen section.

The gross specimen was of firm, slightly nodular consistence, and was slightly blood stained. Section revealed fatty tissue streaked with gray-white firm material, which was not well demarcated. Paraffin sections from various portions of the tumor mass were blocked and stained with the routine hematoxylin and eosin method. These sections showed a bewildering assortment of cells. The stroma was fairly consistently composed of mucoid, connective tissue, and some collagenous connective tissue in which were embedded glandular structures, some of which were lined with cylindrical distorted epithelium, and some of which showed several layers of cuboidal cells. In other places there were papillary outgrowths of this cuboidal epithelium. In one portion there was a mass of epithelium, totally different from that encountered elsewhere in the tumor. This was composed of deeply staining epithelium sometimes arranged in gland ducts, and sometimes in solid plugs. Although mitotic figures were found elsewhere, they were most numerous in this group of cells. From this diversity in cell type and grouping, it would appear that we were dealing with an embryonal malignant type of growth often encountered in the ovary and frequently seen in the kidney, especially seen in young subjects; the prognosis is very bad.

Diagnosis.—Metastatic adenocarcinoma.

Three weeks following operation the patient returned home, but she lived only three months.

19 WEST SEVENTH STREET.

RUPTURE OF THE UTERUS, WITH REPORT OF SEVENTEEN CASES

By Irving W. Potter, M.D., Buffalo, N. Y.

OWING to the many operations upon the uterus, rupture of that organ will be found very frequently as a complication of pregnancy, and is a condition we must be prepared to meet at once.

Let us first consider the uterus. It is a hollow muscular organ with more or less thick walls and is made up of three layers of muscles. We know from our work upon the pregnant uterus that fully 50 per cent of the uteri have some pathologic condition, in that they either contain one or more of the many kinds of tumors common to that organ, or the walls have been weakened from dystocia of the maternal or fetal type, or some of the acute infections have damaged the muscle and have invaded the walls and may have contributed to the various displacements found.

If we consider labor a natural physiologic act through which the woman should pass without injury, we must assume that normal conditions exist in the uterus and pelvis, and in the size of the child. But with a damaged uterus such a condition as a normal physiologic process cannot exist, consequently rupture of one or more, or all of the layers of the uterus is liable to occur and therefore trauma is a frequent cause of rupture; trauma as results from long labor due to maternal or fetal dystocia.

Think back to the years when labors of three or four days' duration were not uncommon, with the uterus contracting violently for a number of hours until muscular exhaustion occurred, followed by periods of rest; and then a recurrence of the contractions took place until finally the child was pushed out into the world and the patient, greatly exhausted by such a labor, gradually rallied; but about the third or fourth day she developed a temperature, rapid pulse, distention of the abdomen, delirium, vomiting, and finally obstruction of the bowels and death. The attendant was charged with having had a case of puerperal fever; and yet these patients, in the light of our present knowledge, had many times, no doubt, a partial rupture of the uterus with escape of the uterine contents into the peritoneal cavity, causing the above symptoms.

Articles are now appearing in the journals advocating the induction of labor by the frequent use of pituitrin and, with our knowledge of the pathologic conditions so frequently found in the uterus, it does seem that such a procedure cannot help but be extremely dangerous and that rupture of the uterus might be an accident which it would

be reasonable to expect. When one sees the rapid and firm contractions of the uterus produced by pituitrin (giving it as we give it by hypodermic injection into the uterine tissue after a cesarean section wound has been closed), one cannot help but be surprised that this disastrous accident does not occur even more frequently.

Rupture of the uterus can be produced by the improper application of forceps, such as application of forceps to the outside of the uterine body (a case was recently seen in consultation where this had been done), application of forceps through an undilated os, application of forceps to an improperly engaged head, attempts to perform version in a case where the uterus is too tightly moulded arounded the child to allow of its being lifted up, and where the membranes have ruptured early, allowing the amniotic fluid to drain away. Any attempt to correct a neglected shoulder presentation, with an arm protruding, is a frequent cause of rupture of the lower uterine segment; in fact, any violent intrauterine procedure when attempted without complete surgical anesthesia could produce a rupture. Cases where the uterine wall has been weakened by the removal of a fibroid tumor or where any inflammatory process has been present, or where one or more cesarean sections have been done, either abdominal or vaginal, especially where the abdominal has been done by the high operation, or in the low two-flap operation, are always to be watched carefully for rupture. Symptoms vary according to whether the rupture is complete or incomplete, whether at an old cesarean scar or in the tissue adjoining the scar, and also as to where the placenta is located. In our specimens sent to the laboratory we have found that muscle tissue is not replaced, and there exists always much fibrous tissue, which has not the power of contracting and relaxing as muscle tissue does; hence, the greater danger of rupture where there is extensive scar tissue which is found in spite of the great vascularity of the uterus in many cases. Incomplete or partial rupture is accompanied by steady and persistent pain in the abdomen, increased size of the abdomen with board-like rigidity, and when there is a sudden cessation of pain, complete rupture must be suspected.

Rupture at term occurring at the seat of an old cesarean scar may cause no special symptoms. The uterine scar simply opens; and, if the placenta is on the posterior uterine wall, the membranes protrude, and a mass is found under the skin of the abdomen, which is readily seen to contain fluid and to fluctuate. Careful examination at the base of this mass reveals the sharp, well-defined edges of the uterine scar. We have had two such cases; both patients were up and doing their housework until told of the condition. There is no pain in this type of rupture.

Rupture at the placental site with the placenta being pushed out into the abdominal cavity is a different picture. In that case there is pain,

continuing until the complete rupture occurs, when the pain ceases, and symptoms of shock due to hemorrhage appear. These patients bleed to death through hemorrhage into the abdominal cavity unless quickly operated upon. Another type of rupture is seen where the fetus is pushed through the rent in the uterine wall, the placenta remaining attached and very little hemorrhage occurring; the child may live for some time, floating about in the coils of intestine, and the uterus retracting and falling down into the pelvis. No special harm to mother or child is found to occur in this type of case if it is recognized early and operation is performed as soon as possible.

The most dangerous type is the one where the uterine wall is very thin and is torn in different directions and both the placenta and the child are expelled into the abdominal cavity accompanied and followed by severe hemorrhage and resulting in death of the mother and child.

A patient, seven or eight months pregnant, complaining of abdominal pain getting more severe, with no intermission, the abdomen becoming distended and board-like to the touch and then with a sudden cessation of pain and the symptoms of shock appearing and getting more profound as time goes on, should be suspected of having a rupture of the uterus. Treatment of this condition is, of course, surgical. The abdomen should be opened and explored, and whether the rupture should be repaired, or whether the uterus should be removed, must be determined by the individual operator. In the cases where the unruptured membranes protrude, the edges of the uterine scar can be freshened after the child and placenta are removed and the tear is repaired. In cases where the placenta is retained and the child is free in the abdominal cavity, the uterus can sometimes be repaired. The cases of extensive rupture in different directions, with the child and placenta in the abdominal cavity, are best treated by removal of the uterus at once.

Where rupture has occurred and the uterus is left, resection of the tubes should be done. The maternal mortality is highest in the last type of case; namely, with the rupture in different directions. The fetal mortality is highest in the last two types of cases, while in the first group described there should be neither maternal nor fetal mortality if treated early.

In our series of 1750 abdominal and vaginal cesarean sections the following ruptures have been known to occur. In the series of 43 vaginal cesarean sections none occurred. In the abdominal sections where the high, medium, and low types of operation were used, they were found as follows:

CASE 1.—Mrs. W., aged thirty, para iii, was seen in consultation with a midwife, who had been in attendance twelve hours. There was neglected shoulder presentation and a hand protruding. Attempts had been made to deliver by traction on the arm. The parts were greatly swollen and discolored, with many abrasions. Chloroform was given and a careful examination was made for suspected rupture; a still-

born child was delivered by version and extraction and then examination was made to ascertain whether or not a rupture existed. None could be found. The patient died in twelve hours. Postmortem examination showed a triangular tear in the lower posterior uterine wall. This patient had never had any operation on her uterus.

CASE 2.—Para ii, aged twenty-two. First abdominal cesarean section was done in July, 1922, for placenta previa with severe hemorrhage at seven months; cervix was long and undilated. Child and mother both well. The patient was seen in Cleveland by Dr. A. J. Skeel in 1925 when six months pregnant and was sent to his hospital for observation. Diagnosis of rupture was made; operation and recovery. This case was reported to me by Dr. Skeel.

CASE 3.—Para ii, aged nineteen. The patient was told to report at the first sign of labor. Instead of doing this, she was all night in labor. When seen in the morning, rupture of the uterus was diagnosed; and she was operated upon at once. We found protrusion of membranes through the old scar. Mother and child recovered. The tubes were resected.

CASE 4.—Mrs. C., para v. At term this patient was to have a third abdominal cesarean section. Seen at her home, a diagnosis of rupture was made, and she was taken to the hospital. A stillborn child was removed; the abdominal cavity was full of blood clots, and the placenta was protruding through the rupture. The old scar was removed and the uterus was sewed up and left. Patient recovered.

CASE 5.—Mrs. B., aged thirty-four, para ii. Diagnosis of rupture was made in my office. Patient was sent at once to the hospital and operated upon. Unruptured membranes were protruding through rupture. Recovery of mother and child.

CASE 6.—Mrs. McC., para ii, aged twenty-three, was to have had a second abdominal cesarean section. There was rupture of the scar necessitating operation; old scar was removed and tubes were resected. Recovery.

CASE 7.—Mrs. P., para ii, aged thirty-two, was to have had a second abdominal cesarean section. There was spontaneous rupture of uterine scar at term. Membranes protruded, old scar was removed, and tubes were resected. Mother and child recovered.

CASE 8.—Mrs. F., para ii, aged thirty-eight, was to have had at term a second abdominal cesarean section. When seen at home, she had severe pain, was vomiting, and in shock; diagnosis of rupture of uterus was made. Morphine sulphate, gr. ¼, was given by hypodermic injection. She was removed to hospital in ambulance; operation was performed immediately. A dead child was found free in the abdominal cavity, and placenta was still attached. The opening in uterus was closed, and tubes were resected. Recovery of mother.

CASE 9.—Mrs. E., aged thirty-seven, para iii. Seen in consultation. She had had two abdominal cesarean sections. Diagnosis of rupture was made. At operation a dead child was found and the placenta was found in the abdominal cavity. Hysterectomy was performed. Recovery of mother.

CASE 10.—Mrs. S., aged thirty-one, para ii, was to have had at term a second cesarean section. Diagnosis of ruptured uterus was made; operation showed membranes unruptured; tubes were resected. Mother and child recovered.

CASE 11.—Mrs. A., aged thirty-one, para iv. Last child was delivered by abdominal cesarean section because of central placenta previa. When seven and a half months pregnant, following a day of hard work, she was taken with severe abdominal pain. A diagnosis of rupture of uterus was confirmed by operation; live child delivered and mother recovered.

CASE 12.—Mrs. P., aged twenty-eight, para ii, near term; to have a second abdominal cesarean section. She had severe abdominal pain, and was taken in my own car to the hospital where diagnosis of rupture was confirmed by operation. Both tubes were resected. Recovery of mother and child.

CASE 13.—Mrs. R., aged thirty-three, para ii, seven months pregnant. Uterus ruptured while patient was in a department store shopping. She was taken to the hospital and operated upon. A live child was delivered, but it only lived six hours. Uterus was removed. Recovery of mother.

CASE 14.—Mrs. C., aged thirty-eight, para ii, had a cesarean section, six years ago. Her physician told her not to become pregnant again, but he did not remove her tubes. I saw her at her home nineteen hours after her first symptoms of severe abdominal pain, followed by shock. She was removed at once to the hospital by ambulance, but died in twenty minutes after being admitted. Dr. Milton Potter, who was present when she was admitted, did a postmortem laparotomy in the hope of saving the child, but was unsuccessful. Child and placenta were found in abdominal cavity. He removed the uterus and found a tear at site of an old scar.

CASE 15.—Mrs. S., weight 84 pounds, para ii (first section, Feb. 16, 1927, for contracted pelvis). When eight months pregnant, she was seized with irregular pains eight hours before entering the hospital. They became more severe; but, not thinking they were of any importance, she continued with her household duties until 2 P.M., when, after reporting her condition over the telephone, she was taken to the hospital. On the way there was a sudden cessation of pain. Patient felt better but was weak. I saw her shortly after admittance to the hospital and a diagnosis of rupture of the uterus was made. No fetal heart sounds could be heard. A soft, boggy mass could be pushed all over the abdominal cavity. Patient showed slight shock. Her skin was cold but she had a fair pulse. She was given 1000 c.c. of 5 per cent glucose solution subcutaneously and was operated upon immediately. Upon opening the abdomen, a number of large blood clots were found, and the unruptured sac containing the child could be easily felt. The membranes were ruptured and a dead baby of about eight months was removed, followed by placenta and membranes. No active bleeding was observed. I then brought the uterus up from down in the pelvis and removed it, closing the abdomen without drainage after putting 1000 c.c. of 5 per cent glucose solution into the peritoneal cavity. Patient was given more glucose under the breasts, and she made a perfect recovery, leaving the hospital in twelve days.

CASE 16.—Mrs. P., para ii, seven and a half months pregnant. First section was done twenty-two months ago for contracted pelvis. Patient was taken with pain in abdomen, resembling labor pains at 4 A.M.; she entered the hospital at 7 A.M., when pains stopped. When seen at 9 A.M., her abdomen was soft and boggy; she had a fair pulse and some evidence of shock. There was slight vaginal discharge; an abdominal mass could be pushed all around. No fetal heart could be heard. A diagnosis of rupture of uterine scar was followed immediately by operation. An unruptured sac was found in the abdominal cavity; uterus was removed. Patient recovered, leaving the hospital in thirteen days. The histories of this case and of the previous one were the same.

CASE 17.—Mrs. L., aged twenty-seven, para iv, was seen in consultation at 9 P.M. She had one living child, delivered by abdominal cesarean section, two years ago. Two other children were lost during delivery. Patient began having severe abdominal pain at noon. She was seen by her physician at 4 P.M., and entered the hospital at 6:30 P.M. When I saw her at 9 P.M., she was in shock. Ruptured uterus was diagnosed and immediate operation was advised. Upon opening the abdominal cavity, a large amount of blood clots were removed and the unruptured sac con-

taining a 7 months' dead fetus was taken from the peritoneal cavity. The uterus was brought up out of the pelvis and removed. A blood transfusion was given but patient died at 2 A.M. from shock and hemorrhage. This patient could have been saved had an early diagnosis been made.

In this group of 17 patients there was a maternal mortality of 3 and a fetal mortality of 9, and in 8 cases mother and child were both saved. One patient who died was a woman who had never had a cesarean section.

Sixteen of these cases occurred in my own practice. One case I am indebted to Dr. A. J. Skeel, of Cleveland, for the privilege of reporting.

SUMMARY

This paper emphasizes: first, the signs and symptoms of rupture of the pregnant uterus; second, the time in pregnancy when we have found rupture to occur; third, the necessity for careful watching of all cases where rupture might be expected, say after the sixth month of pregnancy, because the uterus raises itself out of the pelvis and the tension is greatest because at this time it grows most rapidly; fourth, the fact that gross pathology is found more frequently in the uterus than is generally supposed, and the chief among these pathologic conditions is fibroids, particularly of the intramural type.

689 FOREST AVENUE.

VARIATION IN THE LENGTH OF LABOR

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OBSTETRIC literature is replete with articles dealing with prolonged labor. Beyond discussing such cases as brow and shoulder presentation, most of these articles are concerned with uterine inertia, primary or secondary. There is also a smaller number of contributions describing the pathologic possibilities of short labors. A rather careful search has not revealed any considerable contribution to the study of labors, the lengths of which might be said to be within normal limits.

The following discussion is the result of a statistical study of some 1250 consecutive labors in the University of Virginia Hospital. Abnormally long labors were excluded, because their small number was not statistically significant. The elimination of these few abnormally long labors does not in any way impair the accuracy of the results as averages are not considered. The study covered such items as age and parity of the mother, height and weight of the mother, length of gestation, length of conjugata vera, and height and weight of the child.

Each of these factors was studied for its effect on the length of the first stage, on the length of the second stage, and on the total duration of labor. Two methods of analysis were employed:

1. Pearson's coefficient of correlation. (For description of the use and interpretation of this coefficient, see AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY, April, 1929, pages 278-282 and in *Transactions American Association of Obstetricians, Gynecologists, and Abdominal Surgeons*, 1928, pp. 136-140.)

2. Regression lines plotted on coordinate paper. The coefficients of correlation were fairly striking, and they are herewith presented for purposes of comparison with any later or more complete studies.

TABLE I (A). FIRST STAGE OF LABOR

Age of mother	−.088	±.022
Parity of mother	−.280	±.016
Height of mother	−.045	±.026
Weight of mother	−.019	±.026
Length of gestation	+.021	±.026
Conjugata vera	+.095	±.023
Height of child	−.045	±.023
Weight of child	−.049	±.021

TABLE I (B). SECOND STAGE OF LABOR

Age of mother	−.133	±.026
Parity of mother	−.366	±.014
Height of mother	−.030	±.023
Weight of mother	+.056	±.019
Length of gestation	−.027	±.030
Conjugata vera	−.063	±.026
Height of child	+.085	±.024
Weight of child	+.018	±.021

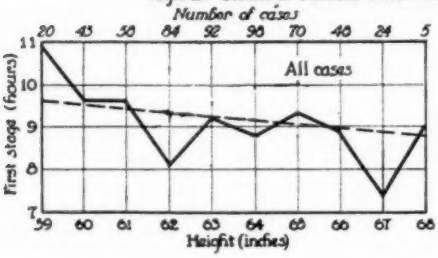
From the data in Table I it is quite evident that none of the factors save age and parity of the mother have any effect on the length of either the first or the second stage of labor. The coefficients are consistently small and in many instances no larger than their probable errors. Age of the mother would seem to be inversely proportional to the length of both the first and second stages and this is, of course, actually true, when we consider all cases. If primiparous and multiparous labors be analyzed separately we have:

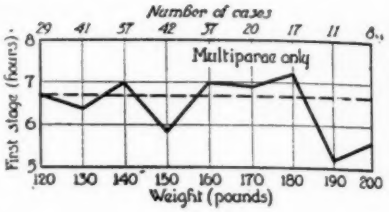
Primiparae—Age of mother; First stage	+.016	±.038
Primiparae—Age of mother; Second stage	−.031	±.038
Multiparae—Age of mother; First stage	−.070	±.032
Multiparae—Age of mother; Second stage	−.030	±.032

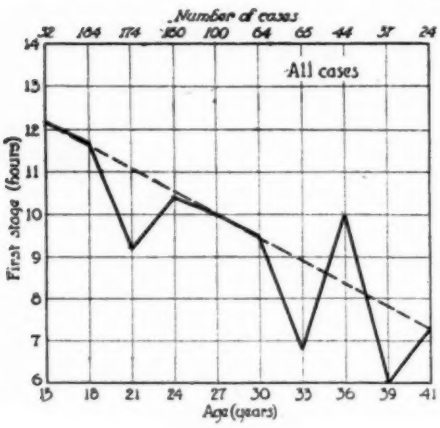
Age thus loses its significance and apparently has no effect on the duration of either the first or second stage. Parity alone then has a high (negative) coefficient and clearly affects the length of labor. The decrease is almost entirely confined to the space between primiparae and secundiparae as will be seen in Fig. 1.

Beginning with secundiparae there is no further decrease in the first stage of labor with succeeding pregnancies. The irregularity in the

Fig. 1a. Clinical Factors Affecting the Duration of Labor




Number of cases
29 41 57 42 37 20 17 11 6
Multiparae only
First stage (hours)
8 7 6 5
120 130 140 150 160 170 180 190 200
Weight (pounds)



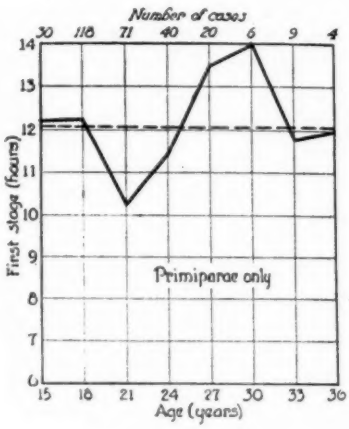
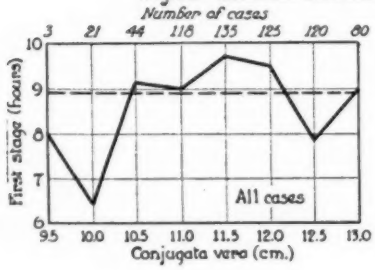
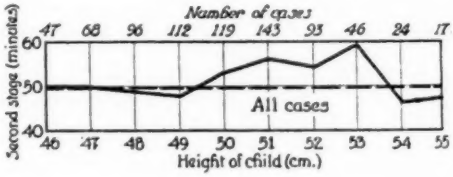
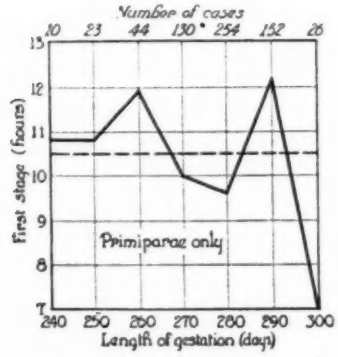
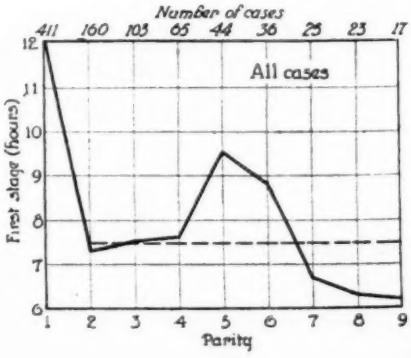


Fig. 1b Clinical Factors Affecting the Duration of Labor




Number of cases
47 68 96 112 119 143 93 46 24 17
All cases
Second stage (minutes)
60 50 40
46 47 48 49 50 51 52 53 54 55
Height of child (cm.)


Number of cases
10 23 44 130 254 152 26
Primiparae only
First stage (hours)
13 12 11 10 9 8 7
240 250 260 270 280 290 300
Length of gestation (days)



curve (Fig. 1 *b*) is not significant. There would seem to be some further shortening of the second stage after the sixth labor although, for practical purposes, one may doubt the significance of so small a change.

The effect of age of the mother is clearly demonstrated by the curves in Fig. 1 (*a*). The apparent inverse relation to age (all cases) is lost when primiparae alone are considered. (Multiparae alone also show a horizontal line.)

All other curves may be regarded as horizontal lines and the conclusion that none of these factors affect the length of either the first or the second stage of labor would seem justified.*

The shorter second stage of labor in multiparae might be explained on the basis of decreased resistance of the cervix, vaginal walls, and pelvic floor. In fact, one might hazard the guess that the *duration of both the first and the second stages of labor is the product of the character of the labor pains on the one hand and the resistance of the soft parts on the other.*

SUMMARY

1. The almost completely negative results of this study would seem to controvert certain beliefs; e.g., the long labor of the fat woman, the long labor of the elderly primipara, and the long labor of the woman with a small pelvis (9.5 or 10.00 cm. conjugata vera) or a large baby.

2. We believe that further studies of the variation in the length of labor will be hereby simplified.

*Coefficients of correlation were computed for primiparous labors, for multiparous labors, and for strictly normal labors, weighing each of the eight factors (age, parity, height and weight of the mother, height and weight of the child, conjugata vera, and length of pregnancy) against both the first and second stages. Curves were plotted covering all of these various relationships. All these coefficents are essentially zero, and the curves are horizontal lines. It seemed, therefore, that publication of them was unnecessary.

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